0629-E-09 I 53.54: SU 7/2000/v.1

43 CFR-3809

Environmental Impact Statement • VOLUME 1

OCTOBER • 2000 • FINAL

Surface Management Regulations for Locatable Mineral Operations

2001-008752/NF

U.S. Department of the Interior • Bureau of Land Management

c

The Bureau of Land Management is responsible for the balanced management of the public lands and resources and their various values so that they are considered in a combination that will best serve the needs of the American people. Management is based upon the principles of multiple use and sustained yield; a combination of uses that take into account the long term needs of future generations for renewable and nonrenewable resources. These resources include recreation, range, timber, minerals, watershed, fish and wildlife, wilderness and natural, scenic, scientific and cultural values.

BLM/WO/PL-00/003+3041

T

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Washington, D.C. 20240
http://www.blm.gov

Dear Reader:

The Bureau of Land Management (BLM) is pleased to present the final environmental impact statement (EIS) on Surface Management Regulations for Locatable Mineral Operations (43 CFR 3809). This EIS analyzes the impacts of five possible regulatory frameworks: Alternative 1 - maintaining the existing regulations (No Action), Alternative 2 - having the states manage the program within their respective borders, Alternative 3 - adopting proposed final regulations at 43 CFR subpart 3809 (Proposed Action), Alternative 4 - maximizing environmental protection, and Alternative 5 - adopting regulations solely to implement recommendations of the National Academy of Sciences - National Research Council report *Hardrock Mining on Federal Lands.*

We encouraged public review and comment on the draft EIS and proposed regulations by distributing copies of both documents to Federal, State, local, and Native American governments and government agencies; Congressional offices; mining interests; environmental organizations; and citizens concerned with the BLM's surface management program for locatable mineral operations. We also made copies of the draft EIS and proposed regulations available at all BLM offices and posted the documents on the BLM homepage (http://www.blm.gov). In addition to accepting written comments, BLM conducted 29 public hearings on the draft EIS and proposed regulations in 16 cities, receiving comments from more than 2,500 individuals and organizations. I am pleased with the level of the public's interest in this rulemaking and the extensive input we received.

The Department of the Interior may decide to select any of the five alternatives presented for analysis. If Alternative 3 (proposed final regulations) is selected, the 3809 regulations that are adopted may differ slightly from the version analyzed in this EIS, depending on further examination of the administrative record.

The EIS contains the following:

- A statement of the purpose and need for the proposed action
- A description of the five regulatory alternatives
- A description of the affected environment.
- An analysis of the environmental consequences
- Comments received on the draft EIS and BLM's responses
- Consultation, coordination, and public participation
- Other items required by the Council on Environmental Quality regulations

Nina Rose Hatfield
Director

Surface Management Regulations
for Locatable Mineral Operations
(43 CFR 3809)

Final Environmental Impact Statement

Prepared by
U.S. Department of the Interior
Bureau of Land Management

Washington, D.C.
October 2000

III

Surface Management Regulations for Locatable Mineral Operations (43 CFR 3809)
Environmental Impact Statement

Draft ( ) **Final (X)**

The United States Department of the Interior, Bureau of Land Management.

1. **Type of Action: Administrative (X) Legislative ( )**

Abstract: BLM is proposing to change the regulations in 43 CFR subpart 3809 for its program to manage operations conducted under the General Mining Law of 1872, as amended, and section 302 of the Federal Land Policy and Management Act of 1976 (FLPMA). This action is intended to modernize and improve the regulations, while increasing environmental protection and facilitating coordination and cooperation with state regulatory agencies having a role in mine permitting.

This final environmental impact statement (EIS) is a national-level, programmatic EIS. It documents the economic, social, environmental, and ecological impacts that would result from alternative frameworks for the BLM surface management program regulating locatable mineral operations on public lands. The Proposed Action is to adopt the recently proposed regulations at 43 CR 3809. Other program alternatives analyzed in this EIS include the following: maintaining the existing regulations (No Action), allowing each state to regulate locatable mineral operations on public lands within its borders (State Management), adopting regulations that maximize environmental protection while still allowing locatable mineral activities (Maximum Protection), and adopting the recommendations of the National Research Council report *Hardrock Mining on Federal Lands* (NRC Recommendations).

For further information contact:

On final EIS:
Paul McNutt
Bureau of Land Management
(775) 861-6604
pmcnutt@blm.gov

On final proposed regulations:
Michael Schwartz
Bureau of Land Management
(202) 452-5198
mschwartz@blm.gov

Contents

VOLUME 1

List of Tables iii

List of Figures iv

Summary 1

Chapter 1: Introduction: Purpose of and Need for Action 11
  Purpose of and Need for Action 11
  The Regulation Development and EIS Processes 13
  BLM Authority and Responsibilities 13
  Cooperating Agencies 14
  Development of the Mining Law and Mineral Policies 14
  History of the Surface Management Regulations 17
  Recent Studies and Changes to the Surface Management Program 17
  Scoping 18
  Issues and Concerns 19
  Issues and Concerns Not Addressed 25

Chapter 2: Proposed Action and Alternatives 29
  Significant Issues 29
    State-Federal Coordination 29
    Notice or Plan of Operations (Plan) Threshold 30
    Performance Standards 30
    Financial Assurance (Bonding) 31
    Enforcement and Penalties 32
    NRC Report Consistency 33
  Regulations Common to All Alternatives 33
  Description of the Alternatives 34
    Alternative 1: Existing Regulations (No Action) 35
    Alternative 2: State Management 43
    Alternative 3: Proposed Regulations (Proposed Action and Preferred Alternative) 46
    Alternative 4: Maximum Protection, Designed-Based Regulations 55
    Alternative 5: NRC Recommendations 60
  Implementation Costs 64
  Alternatives Considered but Eliminated from Detailed Analysis 66
  National Research Council Consistency 67
  Preferred Alternative 68
  Summary Tables 68

Chapter 3: Affected Environment and Environmental Consequences 123
  Introduction 123
  Assumptions for Analysis 125
  Cumulative Effects 127
  Irreversible and Irretrievable Commitment of Resources 128

✓

Environmental Justice 128
Mineral Resource Development 128
Hazardous Materials and Waste Management 152
Climate 156
Air Quality 157
Water Resources 162
Soils 181
Vegetation 185
Riparian-Wetland Resources 194
Aquatic Resources 205
Wildlife Resources 218
Wild Horses and Burros 233
Livestock Grazing 234
Special Status Areas 235
Recreation 238
Visual Resources 243
Cave Resources 247
Paleontological Resource 249
Cultural Resources 250
American Indian Resource Concerns 255
Social Conditions 259
Economic Conditions 265

Chapter 4: Consultation, Coordination, Publication Participation, and Preparers 299
Consultation and Coordination 299
Public Participation 300
Distribution 302
Other Actions 303
List of Preparers 304
Contributors 307
Regulation Team 309

Appendixes A-1
Appendix A—Existing 3809 Regulations A-2
Appendix B—List of People and Organizations to which the Final EIS Is Being Sent A-19
Appendix C—Other Applicable Requirements A-38
Appendix D—State Mining Surface Protection Programs A-51
Appendix E—Changes in Mineral Activities A-123
Appendix F—Plant and Animal Lists A-223
Appendix G—Economics A-245

Glossary G-1

References R-1

Index I-1

List of Abbreviations .... inside back cover

Comments and Responses .... Volume 2

List of Tables

2-1 3809 Regulation Alternatives Summary by Provision 69
2-2 3809 Regulations Summary of Performance Standards by Alternatives 88
2-3 3809 Regulations Summary of Impacts by Alternative 105

3-1 Distribution of BLM-Administered Public Land, Stock Raising Homestead Act Acreage, and Total State Acreage 124
3-2 Notice-Level Activity 136
3-3 Plan-Level Activity 136
3-4 Percentage Distribution of 1997 Notices and Plans by Type of Activity 136
3-5 Total 1997 Plans and Notices in Study Area 137
3-6 Notices of Noncompliance 137
3-7 Acres Disturbed under Alternative 1 140
3-8 Notice- and Plan-Level Operations over a 20-Year Period under Alternative 1 141
3-9 Changes in Mineral Activity under Alternative 2 142
3-10 Number of Operations under Alternative 2 over a 20-year Period 142
3-11 Acres Disturbed under Alternative 2 142
3-12 Changes in Mineral Activity under Alternative 3 145
3-13 Number of Mineral Operations under Alternative 3 over a 20-Year Period 145
3-14 Acres Disturbed under Alternative 3 146
3-15 Changes in Mineral Activity under Alternative 4 148
3-16 Number of Mineral Operations under Alternative 4 over a 20-Year Period 148
3-17 Acres Disturbed under Alternative 4 149
3-18 Changes in Mineral Activity under Alternative 5 150
3-19 Number of Mineral Operations under Alternative 5 over a 20-Year Period 151
3-20 Acres Disturbed under Alternative 5 151
3-21 Outline for Emergency Response Plan 153
3-22 National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments (g/m3) 158
3-23 Condition of BLM-Managed Riparian-Wetland Areas by State 195
3-24 BLM-Managed Fisheries Habitat by State 205
3-25 BLM Aquatic Habitat under or Proposed for Special Status 206
3-26 Numbers of Federally Endangered, Threatened, and Proposed Species on BLM-Managed Lands 222
3-27 Acres of Public Land Open to Location under the Mining Law, and Number of Species on Public Land Protected by the Endangered Species Act 223
3-28 Designated Nationally Significant Cultural Resource Areas 251
3-29 Value of Nonfuel Mineral Production 1980-1998 267
3-30 Estimated Value of "Locatable-type" Nonfuel Mineral Production, Total Value of Nonfuel Mineral Production - 1998 267

3-31 Value of Locatable Mineral Production Originating from Federal Lands 1998 268
3-32 Ranking of Western States by Mine Production of Mineral Commodities - 1998 269
3-33 Precious Metals Value of Production 1998 270
3-34 Base Metal Value of Production 1998 274
3-35 Estimated Regional Impacts from Production of Locatable Minerals on Public Lands 1998 280
3-36 Expenditures for Wildlife-Related Recreation in Study Area 1996 283
3-37 Alternative 2 (State Management) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands 286
3-38 Alternative 3 (Proposed Action) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands 290
3-39 Alternative 4 (Maximum Protection) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Public Lands 294
3-40 Alternative 5 (NRC Recommendations) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Public Lands 297
4-1 Informational and Scoping Meetings for the Draft EIS 301
4-2 Public Hearings on the Proposed Regulations and Draft EIS 302

List of Figures

3-1 Prevention of Significant Deterioration (PSD) Class I Areas 160
3-2 Ground Water Regions Delineated by Heath (1984) 163
3-3 Western States Contribution to U.S. Mine Production of Locatable-Type Minerals in Relation to Land Base - 1998 266
3-4 U.S. Gold Production 1980-1999 271
3-5 Average Gold Prices, 1980-1999 273
3-6 U.S. Copper Production, 1980-1998 275
3-7 National Defense Stockpile Sales and Acquisitions, 1991-1999 277

Summary

This final environmental impact statement (EIS) analyzes the Bureau of Land Management's (BLM) surface management program for locatable mineral operations on BLM-administered lands. The EIS analyzes the environmental impact of the existing regulations and alternatives for the relevant issues recognized during the scoping process.

Purpose Of and Need

The purpose of the Proposed Action is to adopt regulations that would address issues that have developed since BLM's surface management program for locatable mineral operations began in 1981 and to improve BLM's management of locatable mineral activities on the public lands. Issues of general concern include the following:

- BLM's effectiveness and consistency in the day-to-day implementing of the regulations in the field.
- Environmental protection requirements, including performance standards, bonding, and enforcement provisions.
- Working relationships with state regulators in reducing or eliminating duplication of mining plan review, bonding, and permitting.
- Public and stakeholder involvement in the review and approval processes.
- Receiving market value for mining of minerals that may not be locatable under the mining laws but are common variety minerals.
- The validity of mining claims within areas closed to mining.

BLM Authority

The General Mining Law of 1872, as amended, allows the location and use of mining claims on sites "...under such regulations prescribed by law," 30 U.S.C. 22, 26 and 28.

Section 302 of the Federal Land Policy and Management Act (FLPMA) addresses the management of use, occupancy, and development of the public lands. Section 302(b) of FLPMA recognizes the entry and development rights of mining claimants while directing the Secretary of the Interior to "...by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands." These requirements and other legislation authorize BLM to regulate mineral activities so as to prevent unnecessary or undue degradation. The 43 CFR 3809 regulations (3809 regulations) have been prepared to meet that legislative intent.

The 3809 regulations apply to lands that are open to exploration and development under the Mining Law. The regulatory framework is not to decide "if" mining should be allowed but to regulate "how" activities already authorized by the Mining Law are to operate to prevent unnecessary or undue degradation. This framework gives BLM much discretion in regulating exploration and mining on public lands but less discretion in determining whether exploration and mining should occur.

History of the Surface Management Regulations

BLM adopted the 3809 regulations in 1981 after completing a programmatic EIS (BLM 1980). These regulations classify surface disturbance into three categories: casual use, Notices, and Plans of Operations. Casual use involves only negligible disturbance with hand tools and does not require the operator to notify BLM.

Notice-level operations use mechanized earth-moving equipment and disturb 5 acres or less. Operators must submit Notices to BLM at least 15 calendar days before operations begin to ensure that the activity does not cause unnecessary or undue degradation.

A Plan of Operations is required when mining or exploration would disturb more than 5 acres or for any surface disturbance in BLM's special status areas. BLM must review and approve Plans of Operations before operations begin. Since approval of a Plan of Operations is a federal action, an environmental assessment (EA) or environmental impact statement (EIS) must be prepared.

Under the existing regulations reclamation bonding can be required only for Plan-level operations or for Notice-level operations if BLM has issued the operator a record of noncompliance.

When the regulations were published in 1981, BLM made a commitment to review their effectiveness after 3 years. In 1985 BLM formed a work group to consider changing the regulations for reclamation bonding. In 1989 BLM began a initiative to change policy for cyanide use and compliance inspections in response to growing criticism of its managing of mining operations, particularly the issues of wildlife deaths, failure to perform reclamation, and residential occupancy not incident to mining. These issues were the subjects of reports prepared by the U.S. General Accounting Office (1986, 1987a,b, 1988, 1989, 1990, 1991a).

In 1992 a task force of BLM specialists collected public comments and recommended changes to the 3809 regulations (BLM 1992a). In 1993 this revision effort was put on hold because it appeared that pending changes in the Mining Law would supersede any changes in the surface management regulations.

Although these initiatives did not lead to overall revision of the 3809 regulations, the surface management program has undergone several important policy changes since 1981. BLM developed a cyanide management policy in 1990 and adopted state-specific cyanide management plans to give guidance for managing cyanide use on public lands under the existing regulations. In 1992 the BLM *Solid Minerals Reclamation Handbook* (BLM 1992b) was completed as guidance on reclamation practices. In 1996 BLM issued an acid rock drainage policy and published the 43 CFR 3715 regulations on occupancy of mining claims.

In early 1997 BLM revised the 3809 regulations for reclamation bonding, intending to address some of the problems of maintaining adequate reclamation bonds and improving enforcement. But the Northwest Mining Association challenged the 1997 regulations in court for BLM's failure to follow the requirements of the Regulatory Flexibility Act in assessing the effects on small entities. In May 1998 the District Court ruled against BLM, and the 1997 regulation revision is no longer in effect (*Northwest Mining Association v. Babbitt*, No. 97-1013, D.D.C., May 13, 1998).

In February 1999 BLM published the proposed 3809 regulations and draft EIS (BLM 1999b) for public comment. Later that year the National Research Council completed a report (NRC 1999) under the direction of Congress to assess the adequacy of the existing regulatory framework for hardrock mining on public lands.

Consultation, Coordination, and Public Participation

Consultation and Coordination

No cooperating or joint lead agencies participated in preparing this EIS. We coordinated with state governments, state regulatory agencies, American Indian tribal governments, and other federal agencies, including the Environmental Protection Agency, Fish and Wildlife Service, and Bureau of Indian Affairs, in developing the proposed regulations and preparing the draft and final EISs.

In his January 6, 1997 memorandum directing BLM to start the rulemaking process, the Secretary of the Interior directed that "Coordination with state regulatory programs should be carefully addressed, to ensure that

Federal Land Policy and Management Act's purpose of avoiding unnecessary or undue degradation is achieved, while minimizing duplication and promoting cooperation among regulators."

We started working closely with the governors and state agencies of the "Mining Law" states before issuing the Notice of Intent to Prepare an EIS and continued this consultation through the issuance of the Notice of Availability for the final EIS. The importance of this consultation and coordination was reiterated in the 1998 Interior Appropriations Act, which directed the Secretary of the Interior to certify that he had consulted with the affected states. On April 8, 1997, March 3, 1998, and again on September 22, 1998, we participated in meetings hosted by the Western Governors' Association. These meetings focused on concerns about concepts and provisions in the proposed regulations. We also solicited written comments on the drafts of the proposed regulations from the states.

To obtain input from American Indians, we consulted and coordinated with the Bureau of Indian Affairs, the Native American Indian Congress, and tribal governments. We distributed preliminary draft regulations to potentially affected tribal governments and held an information briefing/public meeting on the Fort Belknap Indian Reservation in Montana. In addition, we solicited written comments on the draft EIS and proposed regulations from all federally recognized tribal governments.

While developing the proposed regulations and preparing the draft EIS, we consulted informally with the U.S. Fish and Wildlife Service and U.S. National Marine Fisheries Service on the proposed regulations. In revising the proposed regulations and preparing the final EIS, we prepared a biological assessment of the proposed rules.

Public Participation

In January 1997 the Secretary of the Interior directed BLM to continue with the regulation review process promised in 1981 and begun in 1991. Because of the time that had passed since the 1991 effort, we started a new public participation process in early 1997 and requested comments from its field offices on the existing regulations and suggestions for improvement. We encouraged public participation by the following actions:

- Prescoping outreach to special interest groups and government officials.
- Scoping for the EIS, including a formal 81-day comment period and 19 public meetings in 12 cities.
- Placing the proposed regulations, draft EIS, and related documents on BLM's Internet web site.
- Two public comment periods for the EIS and proposed 43 CFR 3809 regulations, including 29 public hearings in 16 cities.

We analyzed the information gathered during the prescoping outreach and public scoping process and used it to determine the issues addressed and alternatives presented in detail in the draft EIS.

The proposed regulations and draft EIS were subject to public review and comment during two public comment periods. The first period ran from February 9, 1999 to May 10, 1999. Starting on March 23, 2000, we held 29 public hearings in 16 cities on the proposed regulations and draft EIS. In addition to public hearing transcripts, we received more than 2,100 comment letters, including email. After the close of the first comment period we released to the public a content analysis report (BLM 1999c) summarizing the public comments.

On September 29, 1999, the National Research Council (NRC) released its report *Hardrock Mining on Federal Lands* (NCR 1999), which assessed the adequacy of the existing federal/state regulatory program. As directed by Congress, we allowed for a 120-day comment period and requested more public input on the proposed regulations in relationship to the NRC recommendations.

This comment period ran from October 26, 1999 to January 24, 2000, during which we received more than 400 comment letters.

Following this second comment period, we revised the proposed regulations and prepared the final EIS. The final EIS responded to all substantive comments from both comment periods and incorporated changes in response to those comments.

We have encouraged public involvement throughout the process to ensure that the process is open and that we have considered information from all interested parties, including the following:

- Other federal agencies.
- State and local governments.
- American Indian tribal governments.
- The scientific community.
- Professional, conservation, and trade organizations.
- Public land users and stakeholders.
- Citizens at large.

One of the efforts to increase information to the public was to post the proposed regulations, draft EIS, other documents, announcements, and schedules on BLM's Internet web site. The web site was updated regularly to give users the latest information on working drafts of the regulations, schedules, and other information on the project. As of July 31, 2000, the Internet web site had had more than 25,000 visits.

The Regulation Development and EIS Process

Revision of the 3809 regulations is proceeding under Section 553 of the Administrative Procedures Act (APA), 5 U.S.C. 553. BLM has determined that the proposed changes constitute a major federal action significantly affecting the human environment. Therefore, under the National Environmental Policy Act of 1969 (NEPA) an EIS must be prepared.

We have combined the rulemaking and EIS processes wherever possible to eliminate duplication. We held concurrent comment periods, including public hearings on the draft EIS and the proposed regulations, to solicit public comments in accord with the requirements of APA and NEPA.

The EIS is not itself a decision document but a document to help decision makers by disclosing the environmental consequences of implementing the Proposed Action and alternatives. No sooner than 30-days after this final EIS is published, BLM will issue a record of decision selecting an alternative for implementation. This record of decision will most likely be incorporated within the preamble to the final regulations. The record of decision will not contain site-specific decisions for any mining proposals. BLM will make future decisions on mining proposals on a case-by-case basis under the regulations.

Issues

The scoping effort helped us determine the issues we needed to consider in the rulemaking and EIS processes. These issues include the following:

- Definition of *unnecessary or undue degradation*.
- Performance standards for mining and reclamation.
- Definition of federal lands.
- The threshold for a Notice or Plan of Operations.
- Definition of *casual use*.
- Notice and Plan of Operations processing and contents.
- State government coordination.
- Claim validity and valid existing rights.
- Common variety minerals.
- Inspection and monitoring programs.
- Type and adequacy of penalties for noncompliance.
- Reclamation bonding requirements.
- Plan modifications.
- Temporary or permanent closure.
- Appeals process.
- Definition of project area.
- Existing operations.

The following issues were raised but are not within the scope of the 3809 regulations. We therefore did not specifically address them through this rulemaking process or use them to develop alternatives in the EIS.

- The 1872 Mining Law.
- American Indian trust responsibilities.
- Citizen suits.
- BLM cost recovery.
- Agency funding and staffing.
- NEPA processing of Plans of Operations.
- Abandoned mine lands.
- Diligent development.
- Recreational mining.
- Public availability of information.
- Combining the 3809 regulations with occupancy regulations.
- Consistency with the U.S. Forest Service regulations.

Developing the Alternatives

The purpose of the alternatives is to allow the decision maker to consider ways to address and resolve issues recognized during the scoping process or raised during the public comment period. The resolving of significant issues forms the framework of an alternative, with the resolving of lesser issues included around the alternative's central theme. The development of alternatives centered on addressing regulatory issues in six general areas:

- Coordination between BLM and state regulatory agencies.
- The Notice-Plan of Operations threshold.
- Defining performance standards.
- Financial assurance for reclamation.
- Regulation enforcement and penalties for noncompliance.
- Consistency with the NRC report.

Although we considered other relevant issues, these six issues played a major role in defining the alternatives to be analyzed in detail.

State-Federal Coordination - A significant issue consists of maintaining and improving coordination between the states and BLM and of determining the relative level of responsibility for regulating mineral exploration and development. Alternatives developed to address this issue range from turning the program entirely over to state regulation to having BLM always assume the lead role for regulating activities on public lands.

Notice or Plan of Operations Threshold - Under the existing regulations, a Notice is required for surface disturbance of 5 acres or less, whereas a Plan of Operations is required for disturbance of more than 5 acres, or disturbance of any size exceeding casual use in special status areas. BLM received a wide range of comments on this threshold. Some wanted the threshold left as it currently is. Others believed that the requirements to file a Notice or Plan duplicated the filing requirements under state regulatory programs and were not needed. Alternatives 3 and 5 maintain the Notice provision, but change the threshold from 5 acres of surface disturbance to a criterion based on mining versus exploration.

This approach responds to the comments that the Notice or Plan threshold should be driven mainly by the type of activity, not necessarily acres disturbed. Special status areas, where a Plan of Operations is always required, have been expanded under Alternative 3 to address comments that sensitive lands and resources need increased protection. Some commenters were concerned that allowing operations under Notices would never be suitable because no National Environmental Policy Act review or opportunity for public involvement would be required.

Performance Standards - An important aspect of the 3809 regulations consists of the standards that govern how operators must control the extent of impacts on the ground. Alternatives were developed to address comments on the following:

- The environmental resources for which standards should be developed.
- Whether those standards should be design or outcome oriented.

- The level of environmental protection the standards should provide.

Every alternative includes compliance with other state or federal laws and regulations as a minimum performance standard. Federal environmental statutes are summarized in Appendix C, and state regulatory programs are summarized in Appendix D of the EIS.

Financial Assurance (Bonding) - Many commented on the adequacy of financial assurance requirements–generally referred to as bonding–and what these requirements should cover. Typically, bonding is required as a compliance tool to ensure that disturbed land is reclaimed should the operator be unable or unwilling to do so. With the recent district court case on BLM's 1997 bonding regulations, and the NRC report, the issue of reclamation bonding is even more relevant today than when the regulation revision process began. We have developed alternatives for addressing the issue of bonding in response to comments.

Enforcement and Penalties - We received many comments on enforcement and penalties. The enforcement provisions in the alternatives range from maintaining the existing system to establishing mandatory administrative penalties and permit blocks for noncompliance. The range of alternatives we developed for enforcement and penalties respond to comments that assert that enforcement is not a large problem to comments that assert that existing enforcement programs are not strong enough. Alternative 5 limits the regulation changes to those recommended in the NRC report.

NRC Report Consistency

The National Research Council evaluated the adequacy of the existing 3809 regulatory framework. The NRC (1999) report *Hardrock Mining on Federal Lands* contains both regulatory and nonregulatory recommendations for changes in the existing program. The report concluded that improved implementation of the existing regulations presents the greatest opportunity for improved environmental protection and the efficiency of the regulatory process. The NRC report then listed gaps in the existing regulations and recommended regulatory and nonregulatory changes to the program.

After the release of the report, Congress directed that BLM could spend funds only to finalize the proposed 3809 regulations during fiscal year 2000, and that the final regulations could not be inconsistent with the recommendations in the NRC report. BLM considers this requirement as prohibiting the agency from selecting a final regulation alternative that would contradict or oppose a NRC recommendation. Where NRC is silent on an aspect of the existing regulations, BLM-proposed changes would not be inconsistent with any NRC recommendations. In response to this requirement, we have modified Alternative 3, the proposed regulations, so as not to be inconsistent with the NRC recommendations.

Others have commented that the congressional requirement allows BLM to make only the regulation changes that NRC specifically recommended and that any change in the regulations outside those recommended would be inconsistent with the NRC report. We developed Alternative 5 to address this view. Table 2-2 in Chapter 2 of the EIS summarizes the regulatory recommendations in the NRC report.

Alternative 1, retaining the existing regulations, would be inconsistent with the NRC recommendations but would not conflict with congressional requirements because Congress did not require BLM to change the regulations. Congress required only that should BLM make changes, they not be inconsistent with NRC's recommendations.

Alternative 2 would be inconsistent with the NRC recommendations since it would lessen many of the filing, bonding, and operating requirements in direct contradiction to many NRC recommendations.

Alternative 4 is also inconsistent with the NRC recommendations. Eliminating Notice provisions and applying design-based performance standards would impose requirements much greater than those recommended by NRC as needed to protect the public lands.

Although Alternatives 1, 2, and 4 are not consistent with the NRC recommendations, they remain feasible alternatives. They address program issues recognized by the public and could still be selected for implementation if the congressional limitations on contents of the final regulations were lifted or expired.

Description of the Alternatives

This EIS considers five alternatives, including the Proposed Action and the No Action alternatives. Table 2-1 in Chapter 2 of the EIS summarizes each of the components of the five alternatives.

Alternative 1: Existing Regulations (No Action)

Under Alternative 1 the existing surface management regulations at 43 CFR 3809 would continue to be used, and no changes would be made. These are essentially the same regulations that have been in effect since 1981. Over the years BLM has developed policy documents, manuals, and handbooks that give guidance on how the regulations are to be implemented. Appendix A of the EIS contains the existing 3809 regulations.

Alternative 2: State Management

Under Alternative 2 BLM would defer regulating exploration and mining to the states and other federal agencies. The regulations would define ***unnecessary or undue degradation*** to mean failure to meet all local, state, and federal laws and regulations for conducting exploration and mining. BLM would not approve of any specific project. Nor would BLM prepare any NEPA documentation or engage in any consultation under Section 106 of the National Historic Preservation Act.

The operations would still have to comply with federal laws such as the Clean Water Act and Endangered Species Act, but BLM would not regulate the operations. In accordance with the Federal Land Policy and Management Act, BLM would continue to prepare land use plans to determine areas to be opened or closed to operations under the Mining Law through the withdrawal process. State regulators could also use land use plans for information on special management concerns in areas open to operations. BLM would continue to process mineral withdrawals and examine mining claims for validity to meet its land management objectives. But BLM would not be involved in the day-to-day regulation of mineral operations.

Alternative 3: Proposed Action (Preferred Alternative)

Alternative 3 constitutes BLM's preferred alternative, and the proposed regulations would replace the existing regulations at 43 CFR 3809. The regulations have been changed from those presented in the draft EIS in response to public comments and so as not to be inconsistent with the NRC report.

Major provisions of the proposed regulations would include the following:

- Selecting performance standards that all operations would have to meet for environmental protection.
- Replacing the "prudent operator" standard in the current definition of unnecessary or undue degradation with a requirement to comply with the performance standards.
- Redefining unnecessary or undue degradation to include: "...conditions, activities, or practices that...result in substantial irreparable harm to significant scientific, cultural, or environmental resource values of the public lands that cannot be effectively mitigated."

- Adjusting the "threshold" for casual use, Notice-level operations, and filing Plans of Operations.
- Increasing the bonding coverage to include Notice-level activity and requiring bonding at 100% of reclamation costs.
- Extending the regulations to cover federal minerals under private lands, including Stock Raising Homestead Act lands.
- Increasing inspections under some circumstances.
- Being able to issue administrative penalties.

Alternative 4: Maximum Protection

Under Alternative 4 the 3809 regulations would contain prescriptive design requirements for resource protection. These requirements would increase the level of environmental protection and give BLM more discretion in determining the acceptability of proposed operations. Major changes from the current regulations under Alternative 4 include the following:

- Expanded application to public lands with any mineral or surface interest.
- Numerical performance standards for mineral operations.
- Required pit backfilling.
- Eliminating Notices so that all disturbances greater than casual use would require Plans of Operations.
- Required conformance with land use plans.
- Prohibitions against causing irreparable harm or having to permanently treat water.

Alternative 5: NRC Recommendations

Alternative 5 would change the existing regulations only where recommended by the NRC (1999) report. Major provisions of this alternative would include the following:

- Adjusting the threshold for Notice-level operations and filing Plans of Operations.
- Increasing bonding coverage to include Notice-level activity and requiring bonding at 100% of reclamation costs.
- Gaining the discretion to issue administrative penalties.

Summary of Impacts

Table 2-3 in Chapter 2 of the EIS summarizes the environmental, social, and economic impacts of each alternative.

Alternative 1: Existing Regulations (No Action)

Continuing current management would affect environmental conditions, the mining industry, and communities in the same ways as in the past. Mining is expected to remain relatively steady, depending mainly on conditions in commodity markets. Mining-related impacts to water and air quality, soil, vegetation, wildlife, fisheries, riparian-wetlands areas, and other resources are expected to continue at current rates. Economic activity is also expected to continue at current rates, depending on market conditions. Social conditions would not appreciably change.

Alternative 2: State Management

Impacts under the State Management Alternative would be similar to those under Alternative 1. Change in overall mining in the EIS study area is expected range from no change to an increase by as much as 5%, although not necessarily in all locations. For example, activity might not change in California, Montana, and Washington because these states have environmental review provisions similar to the federal National Environmental Policy Act requirements. A change in mining-related impacts to water and air quality, soil, vegetation, wildlife, fisheries, riparian-wetland areas, and other resources is expected to be proportionate with the change in mineral activity. Change in mining-related economic activity would range from no change to an increase of as much as 5%.

Alternative 3: Proposed Action (Preferred Alternative)

Under the Proposed Action mining is expected to decrease for all types and sizes of operations. The following main provisions of the new regulations would affect mining:

- Including a substantial irreparable harm provision to the definition of unnecessary or undue degradation.
- Establishing performance standards.
- Changing the threshold for casual use and Notice and Plan-level operations.
- Increasing bonding levels.
- Eliminating the future use of corporate guarantees.

Mining-related impacts to water and air quality, soil, vegetation, wildlife, fisheries, riparian- wetlands areas, and other resources are expected to decrease proportionately. Overall, mining-related economic activity would decrease by 10% to 28%. Mineral activity might not decrease uniformly in all states because of differences in state regulations and the type of mineral activity prevalent within the state.

Alternative 4: Maximum Protection

Alternative 4 would provide the most environmental protection of the five alternatives. It also has the potential to create the largest decrease in overall mineral activity of all alternatives, ranging from 45% to 69%. Open pit mining is expected to decrease the most–50% to 75%. Strip mining (the typical method for many industrial minerals) is expected to decrease the least–10% to 20%.

Provisions expected to have the greatest effect in reducing the level of future mining include the following:

- Applying the regulations to exiting operations.
- Mandatory backfilling and other restrictive environmental performance standards for reclamation.
- Specific technology design standards.
- Eliminating Notices.
- Native American concurrence.
- Establishing suitability criteria.

Mining-related impacts to water and air quality, soil, vegetation, wildlife, fisheries, riparian and wetland areas, and other resources are expected to decrease proportionately for future operations. In addition, the higher environmental performance standards would further decrease environmental impacts at ongoing and future operations.

Economic activity overall would decrease by 45% to 69% but would vary significantly by state, depending on mine type and commodities most prevalent. Depending on the degree of mining dependence in a community, Alternative 4 could significantly affect social conditions.

Alternative 5: NRC Recommendations

Under Alternative 5 an overall decrease in mineral activity is expected to range from 1% to 6%. Small mining operations that now operate under Notices would undergo the greatest decrease by 5% to 10%. Provisions expected to have the greatest effect in reducing the level of future mining include changing the threshold for Notice- and Plan-level operations, and bonding for Notices. Mining-related impacts to water and air quality, soil, vegetation, wildlife, fisheries, riparian and wetlands areas, and other resources are expected to decrease proportionately for future operations.

BLANK PAGE

Chapter 1

Introduction: Purpose of and Need for Action

This final environmental impact statement (EIS) analyzes the Bureau of Land Management's (BLM) surface management program for locatable mineral operations on BLM-administered lands. The EIS analyzes the environmental impact of the existing regulations and alternatives to the existing regulations for the relevant issues identified during the scoping process. The existing surface management regulations are found under 43 CFR 3809 and presented in Appendix A.

Chapter 1 explains the overall purpose of and need for action, gives a brief background and summary of relevant laws and regulations, and discusses issues suggested by the public and BLM employees for consideration in the rulemaking process. Results from the National Research Council (NRC) study, *Hardrock Mining on Federal Lands* (NRC 1999) are presented where applicable.

Purpose Of and Need for Action

The purpose of the Proposed Action is to address issues that have developed since BLM's Surface Management Program began in 1981 and to improve BLM's management of locatable mineral activities on the public lands. Congress, the General Accounting Office, the National Research Council, BLM, and the public have all recognized the need for improvement in BLM's Surface Management Program under the existing 3809 regulations. Issues of general concern include the following:

- BLM's effectiveness and consistency in the day-to-day implementing of the regulations in the field.
- Environmental protection requirements for operations conducted under the mining laws, including performance standards, bonding, and enforcement provisions.
- Improving working relationships with state regulators to reduce or eliminate duplication of mining plan review, bonding, and permitting.
- Public and stakeholder involvement in the review and approval processes.
- Receiving fair market value for the mining of common variety minerals that may not be locatable under the mining laws.
- Determining the validity of mining claims within areas closed to mining before surface disturbance.

In addition, changes to the existing 3809 regulations are needed to address the following problems or regulatory gaps:

- Financial assurance for reclaiming disturbed areas is now required only for Plan-level activity. BLM cannot require reclamation bonding for Notice-level activity under the existing regulations. NRC recommended that secure financial assurances be required for reclamation of all disturbances beyond casual use, including Notice-level activity.
- BLM has no official way of clearing records for Notices. Notice-level activities are often never completed, or in some cases never started. Without a reclamation bond, or an expiration term, Notices are often left open for years with no incentive for the operator to complete the reclamation, notify BLM, and get the Notice closed.
- Some small mining operations with high environmental risks, such as cyanide use or acid rock drainage potential, can proceed without National Environmental Policy Act (NEPA) review or BLM approval, simply

because they disturb less than 5 acres and qualify for having to submit only a Notice. A 1999 survey of BLM field offices found more than 500 operations that operators had abandoned and left BLM with the reclamation responsibility. These were mostly small mining operations conducted under Notices. NRC recommended that all mining and milling operations be conducted under Plans of Operations and that Notices be used only for exploration.

- BLM lacks clear, consistent standards for environmental protection in the existing regulations. As NRC noted, although mining operations are regulated under a variety of environmental protection laws implemented by federal and state agencies, these laws may not adequately protect all the valuable environmental resources at a particular location proposed for mining development. Furthermore, the existing definition of "unnecessary or undue degradation" does not give BLM authority to protect all valuable resources.
- Mitigation is not defined to allow BLM to require compensation at offsite locations when the disturbed areas cannot be reclaimed to the point of giving plants, animals, and people the same benefits that existed before disturbance. This fact has resulted in an overall decrease in productivity around the areas of operations.
- BLM cannot suspend or nullify operations that disregard enforcement actions or pose an imminent danger to human safety or the environment. Criminal penalties under the existing regulations have often proven ineffective. The existing regulations do allow BLM to use civil penalties as an enforcement tool. NRC recommended that BLM have the authority to issue administrative penalties for violations of the regulations.
- BLM can require modifications to Plans of Operations only after a review by the State Director concludes that the circumstance prompting the modification could not have reasonably been foreseen in the original approval. The NRC recommended that this "looking backward" process should be abandoned in favor of one that focuses on what may be needed in the future to correct the environmental harm. NRC also recommended that the regulations be revised to provide more effective criteria for BLM to require Plan modifications where needed to protect federal land.
- The existing regulations do not distinguish between temporarily idle mines and abandoned operations. This distinction is needed to determine which mines need just to be stabilized, if idle, or which need to be reclaimed, if abandoned. NRC recommended that the regulations be changed (1) to define the temporary versus abandoned conditions and (2) to require interim management plans for operations that are only temporarily closed.
- The existing regulations do not provide for long-term, or perpetual, site maintenance such as water treatment or protection of surface reclamation. NRC recommended that BLM plan for and assure the successful long-term post-closure management of mine sites.
- The lack of clarity in the types of activities permissible under "casual use" has led to inconsistencies and, occasionally, environmental damage. Damage results mostly when many people concentrated in a small area engage in actions that individually fall into the category of casual use. The cumulative impacts of such activities by groups often exceed the "negligible disturbance" in the existing definition of casual use.
- In some operations proposed under the existing 3809 regulations the legal status of the material to be mined is in dispute as to whether it is locatable under the Mining Law or saleable as a common variety mineral. BLM needs regulations to resolve disputes without unreasonably delaying operations.
- The existing regulations have no requirement for preventing disturbances in areas closed to mineral entry until a discovery is determined to be valid or not. In areas closed to the operation of the Mining Law, surface disturbance should be allowed only where the right to mine predates the segregation or withdrawal.

Scoping has identified specific program issues, which are discussed later in Chapter 1. The purpose of the Proposed Action is to adopt regulations that would address the issues and improve BLM's management of locatable mineral activities on the public lands.

The Regulation Development and EIS Processes

Revision of the 3809 regulations is proceeding under Section 553 of the Administrative Procedures Act (APA), 5 U.S.C. 553. BLM has determined that the proposed changes constitute a major federal action significantly affecting the human environment. Therefore, under the National Environmental Policy Act of 1969 (NEPA) an environmental impact statement (EIS) must be prepared.

The rulemaking and EIS processes have been combined wherever possible to eliminate duplication. Concurrent comment periods, including public hearings on both the draft EIS and the proposed regulations, were held to solicit public comments according to the requirements of APA and NEPA.

The integration of the NEPA and APA processes during the revisions of the 3809 regulations is procedurally complex. Interaction between the preparers of the proposed regulations and the interdisciplinary team preparing the EIS resulted in several internal iterations of analysis before the proposed and final regulations were developed.

The two acts also have their own scheduling requirements. The Council on Environmental Quality (CEQ) regulations implementing NEPA require that a decision cannot be made until 30 days after publishing the notice of availability of the final EIS in the *Federal Register*. APA requires a 30-day delay in the effective date of the final regulations after they are published.

The EIS is not itself a decision document. It serves to help decision makers by disclosing the environmental consequences of implementing the Proposed Action and the alternatives. No sooner than 30-days after this final EIS is published, BLM will issue a record of decision selecting an alternative for implementation. This record of decision will most likely be incorporated within the preamble to the final regulations. The record of decision will not contain site-specific decisions for any mining proposals. BLM will make decisions on any future mining proposals on a case-by-case basis under the regulations.

Other requirements for a rulemaking include preparing a cost-benefit analysis. Although related to the economic analysis in the EIS, the cost-benefit analysis involves different assumptions and is prepared for different purposes.

BLM Authority and Responsibilities

The General Mining Law of 1872, as amended, allows the location and use of mining claims on sites "...under such regulations prescribed by law," 30 U.S.C. 22, 26 and 28.

Section 302 of the Federal Land Policy and Management Act (FLPMA) addresses the management of use, occupancy, and development of the public lands. Section 302(b) of FLPMA recognizes the entry and development rights of mining claimants while directing the Secretary of the Interior to "...by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands."

These requirements and other legislation authorize BLM to regulate mineral activities so as to prevent unnecessary or undue degradation on BLM-managed lands open to operations under the Mining Law. The 43 CFR 3809 regulations (3809 regulations) have been prepared to meet that legislative intent.

The 3809 regulations apply to lands that are open to exploration and development under the Mining Law. The regulatory framework is not to decide "if" mining should be allowed but to regulate "how" activities already authorized by the Mining Law are to be conducted to prevent unnecessary or undue degradation. This framework gives BLM much discretion in regulating how exploration and mining are conducted on public lands but less discretion in determining whether exploration and mining should occur if the lands are legally open to operation of the Mining Law. Other processes, beyond the scope of the 3809 regulations, are used to close lands to exploration and development under the Mining Law. Such processes include administrative and congressional withdrawals.

Cooperating Agencies

No formal cooperating agencies were designated for preparing this EIS. BLM coordinated with state regulatory agencies through the Western Governors' Association and with other federal agencies in developing the proposed and final regulations. (See Chapter 4, Consultation, Coordination, Public Participation, and Preparers.)

Development of the Mining Law and Mineral Policies

Before 1866 the United States lacked comprehensive legislation that defined mineral rights and access to minerals on the public lands. From 1797 to 1855 several partial leasing acts (covering lead, iron, salt, and copper) and the Cash Sale Act of 1826 allowed the sale for $5 an acre of lands surveyed by the United States and classified as mineral lands. The rest of the public land could be purchased for $1.25 an acre. Except for the Cash Sale Act, these acts all expired before 1855.

The 1849 California gold rush and the 1854 Nevada silver rush (to the Comstock silver lode in Virginia City) radically changed the entire perspective on mineral rights, access to minerals, and mineral titles on the public lands. Arriving by the thousands from the East Coast and disembarking in San Francisco, miners established themselves along the California mother lode belt (the western Sierra Nevada). Exploring ever eastward, they established hundreds of mining camps in the Sierra Nevada and in the Virginia Range in Nevada.

In the absence of federal legislation on mining rights and titles, the miners established their own rules for acquiring mineral rights, mining claims, and diligence (assessment work). Though everyone was technically in trespass on the public domain, each mining district devised rules based on the Spanish Royal Codes of 1783 and the English customs and traditions of the Cornwall and Devon tin and lead districts. Surviving records show that by 1860 California, Nevada, and Arizona had some 650 mining districts, each with its own rules.

In 1866 Congress finally reacted by passing the Lode Law, which applied only to lode claims. The Lode Law recognized the existing rules of the mining districts, required assessment work for keeping claims, and allowed the patenting of mining claims. In 1870 the Lode Law was amended by the Placer Act, which treated placer claims in a similar manner to lode claims. In 1872 Congress revised the Lode and Placer Acts, added amendments to protect agricultural rights, established federal rules, and passed what is today called the General Mining Law of 1872 or the Mining Law.

U.S. mining laws class minerals as locatable, leasable, or salable. Locatable minerals are neither leasable minerals (e.g. oil, gas, coal, oil shale, phosphate, sodium, potassium, sulfur, asphalt, or gilsonite) nor salable mineral materials (e.g. common variety sand and gravel). Locatable minerals include copper, lead, zinc, magnesium, nickel, tungsten, gold, silver, bentonite, barite, feldspar, flourspar, and uranium. Only locatable mineral deposits may be staked and claimed under the Mining Law.

Under the Mining Law all valuable mineral deposits on lands belonging to the United States are free and open to entry, location, and patent. When minerals are found in enough quantity and quality on public land open to mineral entry, a person who locates a mining claim, complying with regulations prescribed by law, has the exclusive right of possession and enjoyment of the surface area of the claim and the mineral veins, lodes, and ledges within the claim as well as extra-lateral rights.

Principles of the Mining Law

The Mining Law consists of five basic elements:

- **discovery** of a valuable mineral,
- **location** of mining claims,
- **recordation** of claims,
- **maintenance**, performance of annual requirements on claims,
- **patenting** of the mineral, and possibly surface, estate to the claimant.

Discovery

No federal statute defines what constitutes a valuable mineral deposit, but several judicial and administrative rulings or declarations have been made on the subject. In 1894 in the case of *Castle v. Womble* the Department of the Interior established the "prudent person rule." This rule states the following:

> "...where minerals have been found and the evidence is of such a character that a person of ordinary prudence would be justified in the further expenditure of his labor and means, with a reasonable prospect of success in developing a valuable mine, the requirements of the statutes have been met."

This definition was affirmed by the United States Supreme Court in 1905.

In 1968 in the case of *U.S. v. Coleman* the Supreme Court approved the marketability test as a complement to the prudent person rule. This test requires a showing of marketability to confirm that a mineral could be mined, removed, and marketed at a profit. In other words, the marketability test considers economics, requiring claimants to show that they have a reasonable prospect of selling material from a claim or a group of claims. The material does not have to have been sold or to be selling at a profit. There just needs to be a reasonable likelihood that it could be sold at a profit.

Demonstrating an established market for precious and base metals is not difficult because of the international acceptance of metals and their universal needs. For industrial minerals the demonstration of a market is harder to establish because these markets are regional.

Location

Mining claims may be located only by citizens of the United States, persons who have declared an intention to become citizens, and corporations organized under any state law. Mining claims may be located only on public domain lands open to mineral entry under the mining laws and only for mineral commodities considered to be "locatable." A mineral is locatable if it is in the public domain and is a metallic mineral or an uncommon variety mineral valuable chiefly for chemical rather than physical properties.

Upon discovery of a valuable mineral on unappropriated public domain land, a mining claim may be located. This claim grants the locator an exclusive possessory right to the mineral deposit. This possessory right allows the locator to continue to develop the claim as provided for by law. A mining claim is a valid right against the United States and other claimants only if a valuable mineral deposit has been discovered.

There are four types of mining claims. The main types are lode and placer. Lode claims are located on bedrock, whereas placer claims are usually located on loosely consolidated materials such as mineral-bearing sands and gravels. A mill site claim may be located on unappropriated public domain land that is nonmineral in character and may be used for erecting a mill or reduction works, or for other uses reasonably incident to support of a mine. A tunnel site claim may be located on land where a tunnel is run to develop a vein or lode, or for intersecting unknown veins or lodes.

The actual location of a mining claim involves posting a notice of location at the discovery point and erecting corner posts, or monuments, on the ground to ensure that the claim boundaries are readily recognizable.

Recordation

Before enactment of the Federal Land Policy and Management Act of 1976 (FLPMA), claimants were required to file their location and assessment notices only in the office of the county recorder or county clerk in the county in which the claim was located. Under FLPMA, notices of location and other notices must be filed with the BLM state office as well as the county recorder. This requirement has allowed BLM to generally know the number and types of claims on public land and their current status. To file a mining claim, the claimant must also pay a recordation fee. Failure to file these documents and pay the fee can constitute abandonment of a mining claim.

Maintenance

The Mining Law requires the annual performance of at least $100 worth of labor or improvements to retain a possessory interest in the claim or site. An affidavit of assessment work must be filed with both the county recorder and with the BLM state office. Owners of mill and tunnel sites are not required to file assessment work but must file a notice of intent to hold the site. Congress has changed the annual assessment work requirement by substituting a requirement to pay BLM a $100 maintenance fee per mining claim. A claimant with fewer than 10 mining claims can perform the assessment work and file a small-miner exemption. Failure to pay the maintenance fee or obtain a waiver from BLM will constitute forfeiture of a mining claim.

Patents

One need not have a patent to mine and remove minerals from a mining claim. A patent gives the owner exclusive title to the locatable minerals and in most cases to the surface estate. To obtain patent, claimants must do the following:

- Perform at least $500 worth of development work per claim.
- Have a mineral survey and plat prepared at their expense.
- Show that they hold possessory rights by chain of title documents.
- Publish a notice for potential adverse claimants to assert their claims.
- Demonstrate discovery of a valuable mineral deposit within the meaning of the Mining Law.

Upon satisfactory completion of the above requirements, claimants can purchase their mining claims at $2.50/acre for placer claims and $5/acre for lode claims.

Since 1994, Congress has established and continued a moratorium on filing new patent applications. The only patents now being processed are those that have received the first half of the mineral entry final certificates.

Mining Law Amendments

The Mining Law has been amended several times since its passage in 1872. The most important amendments are as follows.

The Mineral Lands Leasing Act of 1920 removed oil, gas, coal, sodium, potash, oil shale, and phosphate from the provisions of the Mining Law and made them leasable minerals. Geothermal energy was added as a leasable mineral in 1970.

The Surface Resources Act of 1955 removed sand, gravel, cinders, and other construction materials from the provisions of the Mining Law and made them subject only to contract sales. This act also made all mining claims subject to the right of the United States to manage the surface resources on the claims and made it illegal to use and occupy a mining claim or site except for legitimate mining, milling, or exploration.

The Federal Land Policy and Management Act of 1976 (FLPMA) established a national-level recording system for all mining claims and required that in managing the public lands the Secretary of the

Interior shall, by regulation or otherwise, take any action needed to prevent unnecessary or undue degradation of the lands. FLPMA also requires the Secretary to develop and maintain land use plans for the public lands. One purpose of land use plans is to select areas to be withdrawn from operation of the mining laws.

Several other acts shape BLM's management of minerals on public land. These acts include the **1970 Mining and Mineral Policy Act** and the **1980 National Materials and Minerals Policy Research and Development Act**, both of which require that the public lands be managed to recognize the Nation's need for domestic sources of mineral production.

In addition, a variety of state and federal environmental laws regulate locatable mineral activities. The federal and state laws on air and water quality, wildlife, and hazardous materials apply to all operations on BLM-managed lands. In addition to BLM requirements, states have passed their own permitting and reclamation laws, which apply to activities on public lands.

History of the Surface Management Regulations

BLM adopted the 3809 regulations in 1981 after completing a programmatic EIS (BLM 1980). The existing 3809 regulations are presented in Appendix A and described in Chapter 2. These regulations classify surface disturbance into three categories: casual use, Notice-level operations, and activities under Plans of Operations, also referred to as Plan-level operations.

Casual use involves only negligible disturbance, usually with hand tools or nonmechanized earth-moving equipment and does not require the operator to notify BLM.

Notice-level operations may use mechanized earth-moving equipment but only disturb 5 acres or less. For these operations BLM must be notified 15 calendar days in advance to ensure that the activity does not cause unnecessary or undue degradation.

A Plan of Operations is required for more than 5 acres of surface disturbance or any surface disturbance in BLM's special status areas, such as areas of critical environmental concern (ACECs). BLM must review and approve a Plan of Operations before an operation begins. Since approval of a Plan of Operations is a federal action, an environmental assessment (EA) or environmental impact statement (EIS) must be prepared. Reclamation bonding can be required only for Plan-level operations under the existing regulations or for Notice-level operations if BLM has issued the operator a record of noncompliance.

Since the original rules were issued in 1981, they have had several legal challenges. The factual basis for the regulations and the legal status of the Notice were the main issues in a 1986 suit filed by the Sierra Club. Issues raised included the adequacy of the 1980 EIS (BLM 1980) and whether a Notice was a federal action requiring environmental review under National Environmental Policy Act (NEPA), similar to a Plan of Operations. The Ninth Federal Circuit Court ruled, among other matters, that a Notice, as constructed in the 3809 regulations, was essentially an enforcement tool (to remind operators of their reclamation responsibilities), and enforcement actions were exempt from the requirements of NEPA. See *Sierra Club et al. v. Penfold et al.*, 664 F. Supp. 1299 (District of Alaska, 1987); aff'm *Sierra Club v. Penfold*, 857 F. 2d 1307 (9th Circuit, 1988).

Recent Studies and Changes to the Surface Management Program

When the regulations were published in 1981, BLM made a commitment to review their effectiveness after 3 years. In 1985, a BLM work group was formed to consider changes to the regulations relating to reclamation bonding. In 1989 BLM began a surface management initiative to make policy changes for cyanide use and compliance inspections in response to growing criticism of its management of mining operations, particularly the issues of wildlife deaths, failure to perform reclamation, and residential occupancy not incident to mining. These issues were the subjects of reports prepared by the U.S. General Accounting Office (1986, 1987a,b, 1988, 1989, 1990, 1991a).

In 1992 a task force of BLM specialists collected public comments and recommended changes to the 3809 regulations (BLM 1992a). In 1993 this revision effort was put on hold because it appeared that pending changes in the Mining Law would supersede any changes in the surface management regulations.

Although these initiatives did not lead to overall revision of the 3809 regulations, the surface management program for implementing the regulations has undergone several important policy changes since 1981. A cyanide management policy was developed in 1990, and state-specific cyanide management plans were adopted to give guidance for managing cyanide use on public lands under the existing regulations. In 1992 the BLM *Solid Minerals Reclamation Handbook* (BLM 1992b) was completed to give guidance on reclamation practices. In 1996 BLM issued an acid rock drainage policy as guidance for program staff and managers for regulating mining. Also in 1996 BLM published the regulations at 43 CFR 3715 on occupancy of mining claims.

In early 1997 BLM revised the 3809 regulations for reclamation bonding. These changes were intended to address some of the problems BLM was experiencing in maintaining adequate reclamation bonds and improving its enforcement program. But the Northwest Mining Association challenged the 1997 regulations in court for failure to follow the requirements of the Regulatory Flexibility Act in relation to assessing the effects on small entities. In May 1998 the District Court ruled against BLM, and the 1997 regulation revision is no longer in effect (*Northwest Mining Association v. Babbitt*, No. 97-1013, D.D.C. May 13, 1998).

In February 1999, BLM published the proposed 3809 regulations and draft EIS (BLM 1999b) for public comment. Later that year the National Research Council prepared a report under the direction of Congress to assess the adequacy of the existing regulatory framework for hardrock mining on public lands. This report, *Hardrock Mining on Federal Lands*, was completed on September 29, 1999. The NRC report (NRC 1999) concluded that improvements in implementing the existing regulations present the greatest opportunity for improving environmental protection and the efficiency of the regulatory process. The NRC report then listed gaps in the existing regulations and recommended regulatory and nonregulatory changes to the program. These recommended changes are discussed as part of scoping in the next section.

Scoping

In January 1997 the Secretary of the Interior directed BLM to restart the regulatory review process promised by BLM in 1981 and again in 1992. In March 1997, BLM appointed a task force of agency staff experienced in the program to coordinate public involvement, develop regulation options, and oversee preparation of a programmatic EIS on the effect of any changes in the regulations.

Because of the time that had passed since the 1992 effort, BLM conducted an extensive public participation process starting early in 1997. From March through May 1997, BLM held briefings on the revision process for conservation and industry groups; congressional offices; the Western Governors' Association; and local, state, and federal government agencies. BLM also requested comments from its field offices on the adequacy of the existing regulations along with suggestions for improvement.

An April 4, 1997 *Federal Register* notice announced preparation of the EIS, requested comments on the scope of the analysis in the

EIS, and set forth a schedule for public scoping meetings. To collect a wide range of comments BLM arranged for public meetings to be held at a variety of locations across the country in the spring of 1997. (See Chapter 4: Consultation, Coordination, Public Participation, and Preparers.)

To establish a framework for the scoping process BLM presented the following list of topics, including those specified in the Secretary of the Interior's memorandum and others that had previously been named as program issues:

- Definition of *unnecessary or undue degradation*.
- Need to develop specific performance standards for mining and reclamation.
- Five-acre disturbance threshold between a Notice and a Plan of Operations.
- Effectiveness of coordination among state and federal regulators.
- Type and adequacy of penalties for violating the regulations.
- Review time frames for Notices and Plans of Operations.
- Definition of *casual use*.
- Requirements for reclamation bonding.

Participants were also invited to comment on any other issues of concern with respect to the surface management program.

BLM formally accepted scoping comments through June 23, 1997, but the record remains open until the final regulations are completed. In addition to oral comments at the public meetings, BLM received 1,832 comment letters on revising the 3809 regulations. A more detailed presentation of the comments received during scoping may be found in the September 1997 Scoping Report (BLM 1997a) available from BLM.

The results of the NRC (1999) report also constitute scoping comments in that NRC provided professional input on the existing regulatory program and suggested new issues or possible alternatives. NRC findings and recommendations are included in this section.

Issues and Concerns

Scoping helped BLM determine the issues that needed to be considered in the rulemaking and EIS processes. These issues include the following.

Definition of *Unnecessary or Undue Degradation*

The Federal Land Policy and Management Act charges the Secretary of the Interior with preventing "unnecessary or undue degradation" of the public lands. The current definition of "unnecessary or undue degradation" is set forth in the 3809 regulations. Whether the existing definition is adequate or should be expanded to include items such as the use of best available technology and practices (BAT) was the subject of a wide range of comments.

A large segment of industry and some agency staff assert that the existing definition is workable and flexible and should not be changed. Many commenters questioned exactly what was meant by BAT and were concerned that it would lock industry into "one-size-fits-all" design standards that ignore site-specific characteristics, fail to consider economics, and stifle innovation.

On the other hand, many commented that the current definition is too open to interpretation and, hence, abuse. They asserted that a less subjective definition is needed, and that "prudent operator" and "usual, customary, and proficient," terms used in the existing regulations, neither ensure the feasibility of control technology nor adequately protect public land resources.

BLM also received comments on setting a specific threshold for unnecessary or undue degradation on the basis of measured impacts (e.g. rills greater than 3-inches deep, any offsite impacts, impact greater than if BAT were used). Some commenters recommended that the land use planning process specify stated levels of protection for sensitive resources and locally refine the definition of unnecessary or undue degradation. Other commenters felt that the definition should include items such as the following:

- Prohibiting irreparable resource damage.
- Requiring logical mineral development sequencing.
- Prohibiting uses not reasonably incident to mining or milling.

NRC recommended that BLM prepare guidance manuals and conduct staff training to communicate its authority to protect resources that may not be protected by other laws. NRC noted that the current regulatory definition of unnecessary or undue degradation does not explicitly provide authority to protect valuable or sensitive resources that are not protected by other laws. Some resources may deserve to be protected from all impacts, whereas other resources may withstand some impacts with mitigation.

Performance Standards for Operations and Reclamation

The existing regulations include general performance standards such as preventing unnecessary or undue degradation and complying with all other environmental laws. Whether specific performance standards should be developed, and if they should be design based or outcome based, was the subject of comment.

Comments ranged from "do not have any standard other than preventing unnecessary or undue degradation" to "develop uniform national design standards for operations and reclamation." Many commenters were concerned that "one-size-fits-all" national standards would not be flexible enough to account for site-specific conditions. Other commenters thought that the current general industry were not an acceptable minimum for public lands. There was concern that BLM-developed standards would conflict with standards used by states with primacy under the Clean Water Act. Many felt that if standards were developed, they should be outcome-based performance standards rather than having a certain design or technology mandated by BLM.

Comments on the standards for pit backfilling varied. Some felt backfilling should always be required to bring the land surface back to premining conditions. Others noted that pit backfilling would make many mines uneconomic and was not feasible in all cases. Several noted that pit backfilling can create greater environmental impacts than leaving pits open after mine closure. Others argued that water quality in postmining pit lakes poses a potentially permanent hazard.

NRC recommended that BLM continue to base permitting decisions on the site-specific evaluation process provided by NEPA. NRC also recommended that BLM continue to use comprehensive performance-based standards rather than using rigid, technically prescriptive standards. NRC noted that BLM should regularly update technical and policy guidance to clarify how statutes and regulations should be interpreted and enforced. Although a variety of environmental protection laws regulate mining, NRC determined that these laws may not adequately protect all the valuable environmental resources, such as springs, seeps, riparian habitat, ephemeral streams, and certain types of wildlife.

Definition of Federal Lands

The existing 3809 regulations apply only to BLM-managed surface where the mineral estate is subject to the mining laws. In certain situations under the current requirements at 43 CFR 3814, BLM does process Plans of Operations and administer bonding on behalf of the surface owner where the surface is privately owned and the minerals are federally owned. This situation generally applies to (1) lands patented under the Stock Raising Homestead Act, where the government reserved the locatable minerals or to (2) other lands where the minerals were reserved from a sale or exchange. Some commented that the 3809 regulations should apply to these lands. Another comment was that regulations were needed on lands where BLM manages only the surface but the mineral estate is held in private or state ownership. According to this comment, the 3809 regulations are best suited for this situation because they were formulated to address the private development rights of mining claimants.

Threshold for a Notice or Plan of Operations

At present most mineral activities that disturb less than 5 acres during any calendar year operate under a Notice and do not require BLM approval. Operations that disturb more than 5 acres need a Plan of Operations, review under the National Environmental Policy Act, and BLM's formal approval. Comments varied from raising the threshold and having more Notices to eliminating the Notice provision entirely and requiring all activity greater than casual use to have approved Plans of Operations. Comments proposed various acreage thresholds. Other suggestions proposed basing the threshold on impacts instead of acreage, or on the type of activity by retaining Notices only for exploration and requiring Plans of Operations for mining.

Secretary Babbitt also directed BLM to analyze impacts of adopting the Forest Service threshold of significant disturbance for a Plan of Operations. Concern was expressed about the amount of time BLM would take to process a large increase in the number of Plans of Operations and the increased workload that would result from making Notices federal actions under the National Environmental Policy Act.

NRC recommended that Plans of Operations be required for mining and milling operations other than those classified as casual use or exploration, even if the area disturbed consists of less than 5 acres. NRC also believes that a Plan of Operations should generally be required for activities involving bulk sampling due to the significant amount of disturbance that can occur from this form of advanced exploration. NRC concluded that, with financial assurance, the 5-acre threshold appears reasonable for requiring exploration disturbance to go to a Plan of Operations.

Definition of Casual Use

Casual use refers to activities causing negligible surface disturbance where an operator does not have to notify BLM or submit either a Notice nor a Plan of Operations. Comments on clarifying the definition of casual use focused on such topics as the acceptable size (if any) of a portable suction dredge, the use of explosives or earth-moving equipment, underground mining, and the impacts of recreational mining. Comments varied from stating that any activity producing a salable commodity was not casual use to casual use should allow up to 1 acre of disturbance. Commenters gave examples of environmental degradation caused by the cumulative impacts of casual use, such as concentrated weekend mining by recreation groups.

NRC (1999) commented that it favors BLM retaining the distinction for casual use operations and that it believes BLM is properly regulating small suction dredging operations under the current regulations as casual use.

Notice and Plan of Operations Processing and Contents

Comments were received on the amount of time BLM takes to process Notices and Plans and what amount of time is suitable. Many commenters felt that the current Notice time frame of 15 calendar days is too short and suggested more review time to assure that resources are adequately protected. Comments on Plans of Operations criticized the excessive time (years) needed to get through the National Environmental Policy Act process or some other statutory review and stated that few Plans can be approved in 90 days if impacts are controversial or significant.

Some commenters requested that the review process be speeded up, whereas others wanted it slower to allow more public involvement. An automatic approval provision was recommended for cases in which BLM would fail to meet review time frames. Some suggested that the problem is not with the time frames themselves but with BLM's low staffing levels and budget. Commenters suggested that BLM specify that it must receive a "complete" Plan or Notice before the start of any time frame and that a completeness process be developed in the regulations.

NRC (1999) had several recommendations for the contents and processing of Plans of Operations. NRC believed that with adequate bonding for reclamation, small miners should receive expedited permits. NRC also concluded that the current BLM 3809 regulations with a 15-day response time for Notice-level exploration should be retained.

NRC recommended that from the earliest stages of the NEPA process, all agencies with jurisdiction over mining or affected resources should be required to cooperate in the scoping, preparation, and review of EISs or environmental assessments for new mines. Tribes and nongovernmental organizations should be encouraged to participate from the earliest stages. NRC also suggested that BLM develop procedures to enable it to determine, in the review and approval process for Plans of Operations, the kinds of postmining requirements that are likely to arise and to incorporate these requirements into the approved Plan of Operations.

In addition, NRC recommended that (1) BLM plan for and implement a more timely permitting process, while still protecting the environment, and that (2) the lead agency set and achieve deadlines and have enough qualified staff to do so. BLM should compile and study information on the time involved in recent reviews to determine causes for delays.

State Government Coordination

Because most states have reclamation laws with environmental permitting requirements that also apply on BLM lands, coordination between BLM and state regulatory agencies is essential. Comments tended to be divided over who should develop the regulations for BLM-managed lands. Some commented that consistent nationwide federal rules are needed to provide a minimum standard and that BLM must retain primacy on public lands. Others commented that current state programs are adequate and more suitable for local conditions and that BLM should not duplicate them. Commenters also suggested that BLM "certify" state programs for the public lands and retain oversight.

NRC pointed out that given the variation in topography, climate, and area of federal lands open to hardrock mining in any state, differences in state laws, and local differences in public attitudes toward mining, consistency among state agreements may not be needed or even desirable.

Claim Validity and Valid Existing Rights

Some comments recommended that to prevent unnecessary or undue degradation and mining scams, BLM should determine if an economic deposit exists before permitting operations. Others commented that BLM should conduct claim validity exams on all lands before accepting Notices or approving Plans of Operations, or that BLM should conduct validity exams on claims in withdrawn areas or special management areas before allowing mining.

Common Variety Minerals

A current problem is that Notices or Plans of Operations are filed for mining of material that may not be locatable under the Mining Law but rather should be sold as common variety materials. The present policy is to process the 3809 action and collect potential royalties in escrow while the locatable versus salable nature of the material is determined. Comments recommended that this procedure be included in the 3809 regulations or that some other procedure be devised to address this issue.

Inspection and Monitoring Programs

BLM inspects operations to determine if operators are complying with the regulations. But particularly on large projects, operators are responsible for conducting the routine environmental monitoring and reporting the results. Comments suggested that the regulations do the following:

- Mandate a set inspection frequency by BLM.
- Require operators to hire independent outside consultants to conduct environmental monitoring.
- Allow citizens to accompany BLM on inspections.

Other comments said that self-monitoring was acceptable if BLM verified the results and that the frequency of inspections should be based on the individual risk of the operations and not be specified in the regulations.

NRC concerns about inspection and monitoring focused on post-closure issues. NRC noted that an important part of long-term management will be monitoring, inspection, and low-level maintenance of reclamation features, such as soil cover, vegetation, closed impoundments, waste rock piles, and water diversion structures. In some cases the quality of surface or ground water must also be monitored.

Type and Adequacy of Penalties for Noncompliance

The issue of penalties for noncompliance was presented to the public because the current system does not include administrative penalties but relies on filing complaints in federal court. Comments on this issue varied from those who felt that BLM should stay away from any penalty system to those who favored stronger penalties and permit revocations for noncompliance. Some industry representatives favored an intermediate administrative penalty system and process as a way of resolving cases before court proceedings begin. Several related issues arose during scoping. Among these were using compliance history as a basis for future permit decisions, revoking mining claims or permits for noncompliance, and blocking future permits for noncompliance.

NRC recommended that BLM should have both (1) authority to issue administrative penalties for violations of their regulatory requirements, subject to due process and (2) clear procedures for referring activities to other federal and state agencies for enforcement.

Reclamation Bonding Requirements

The regulations published in February 1997 required some form of financial assurance for reclaiming all Notice- and Plan-level operations. In May 1998 these regulations were remanded to BLM and are no longer in effect. As part of the overall revision of the 3809 regulations, BLM asked for more comments on this issue. One comment suggested eliminating the requirement in the 1997 version for bond cost estimates to be certified by a third-party registered professional engineer. Some commenters wanted the bonding requirement eliminated, or eliminated for Notice-level operations or small mines. Others wanted all surface disturbance, regardless of size, to be fully bonded for reclamation.

Still others commented that the bond amount should be expanded from covering just the reclamation costs to include the possible costs of an accidental spill, release, or structural failure. BLM's administering of a nationwide bonding pool was suggested as a way to provide bonding for small operators. Comments further suggested that (1) bonds need to be held for years past mine closure in certain areas to ensure reclamation success and (2) that public notification and comment should be obtained on the bond amount and before bond release.

The NRC (1999) report made several comments on financial guarantees. NRC concluded that the financial mechanisms be secure and liquid enough to allow responses to near-term needs. NRC found that current procedures for financial assurance inadequately protected the public and the environment. NRC recommended that financial assurance be required for reclaiming disturbances to the environment caused by all mining activities beyond casual use, even if the area disturbed is less than 5 acres. Financial assurance instruments should also be updated with changing conditions that might affect the levels of bonding or other forms of financial assurance.

NRC further recommended that BLM establish standard bond amounts for certain types of activities on specific kinds of terrain. A set of activity- and terrain-dependent standard bond amounts should be established for typical activities in lieu of detailed calculations based on the engineering design of a mine or mill. Suitable types of financial assurance should be investigated for long-term water treatment. NRC also encouraged the use of bond pools to lessen the financial burden on small miners. NRC stated that it did not intend that bonding of exploration result in a federal action that would automatically require an environmental assessment or EIS.

Plan Modifications

Another issue discussed by NRC was the Plan modification process, through which BLM, when finding a problem with an ongoing operation, can require that the Plan of Operations be modified. NRC recommended that BLM revise its regulations to give more effective criteria for modifications to Plans, where necessary, to protect federal lands. NRC noted that staff comments and documents suggest that the regulations should be modified to improve criteria for modifications, require periodic reviews, and/or specify expiration dates for approved Plans of Operations to assure the opportunity to adjust practices where needed. But NRC did not determine if Plans of Operations should be reviewed or reopened at predetermined intervals.

Temporary or Permanent Closure

NRC made two recommendations on temporary or permanent closure. The first recommendation is that BLM adopt consistent regulations that do the following:

- Define conditions under which mines will be considered temporarily closed.
- Require that interim management plans be submitted for such periods.
- Define the conditions under which temporary closure becomes permanent and all reclamation closure requirements must be met.

The second recommendation is that BLM should plan for and assure the long-term post-closure management of mine sites on federal lands.

NRC went on to state that BLM should consider land uses suitable for closed and reclaimed mines and whether any uses should be controlled or precluded. NRC noted that management requirements need to address and assure the following:

- Future mineral access.
- Measures to protect the public from safety hazards.
- Measures to assure integrity of closed waste units, including monitoring and repair.

- Long-term environmental monitoring with corrective measures.
- Operation and maintenance of water treatment facilities needed to maintain water quality compliance over the long term.
- Financial assurance for implementing these post-closure management requirements.

Appeals Process

Under the existing regulations, operators can appeal to the BLM state director and then to the Interior Board of Land Appeals (IBLA). Parties other than operators must appeal directly to IBLA. Decisions are in full force and effect during an appeal unless a written request for a stay is granted.

Several entities commented on the appeals process. One comment suggested that, upon appeal, the decisions of the authorized officer be automatically stayed (put on hold) until the appeal has been fully considered. Another comment recommended that the appeals process for operators and third parties be the same and have a state director review provision.

Definition of Project Area

The current definition of a project area is a single tract of land upon which operations are conducted and one or more mining claims have been filed under one ownership. Some comments stated that the definition should allow for multiple claim ownership where a single operator is mining. Other comments stated that a project area should include underground mining beneath BLM lands and support facilities not on the claims, and that a permit or project area boundary be specified to define individual project areas.

Existing Operations

If the regulations are changed, the question of how they would apply to existing or pending operations must be addressed. Comments ranged from exempting existing operations to giving existing operations a set period of time in which to comply with any new requirements.

Issues and Concerns Not Addressed

The following issues were raised but are not within the scope of the 3809 regulations and were neither addressed through this rulemaking process nor used to develop alternatives in the EIS.

1872 Mining Law

The issues of patenting of mining claims and lack of royalties on mineral production are outside the scope of the surface management regulations. These provisions are part of the ongoing national debate over the Mining Law and are best addressed through congressional action.

American Indian Trust Responsibilities

Commenters stated that mining has affected American Indian lands, resources, and people, and that the 3809 regulations should be written to preclude activities with those impacts. Also raised were the following concerns:

- The public lands are important to American Indians for their traditional cultural values.
- These lands are not being protected from mining by the 3809 process.
- These types of impacts violate Executive Order 12898 on Environmental Justice.

These issues are commonly raised for many activities on public lands and are larger in scope than the 3809 regulations. The 3809 regulations are not used to review or approve mining on Indian lands. BLM's American Indian trust responsibilities are defined through legislation, executive order, and Department of the Interior policy, regardless of the type of activity or degree of specificity in regulations. To maintain consistency in how BLM executes its trust responsibilities, the EIS does not consider alternatives that would establish separate trust responsibilities specific to mining. But as part of its impact analysis, this EIS does address the effect of the alternatives on American Indian social, cultural, and religious concerns.

Citizen Suits

Scoping comments requested that the 3809 regulations incorporate "citizen suit" provisions to allow citizens to enforce the regulations through the court system. The emphasis of these comments was that citizens need to gain access to mining projects and see firsthand the inspections that are being conducted because BLM is not promptly responding to citizen complaints. Provisions for citizens to accompany inspectors are within the scope of the regulations and are included in the alternatives discussion. But the underlying authority does not provide for establishing a citizen suit provision (Federal Land Policy and Management Act) and citizen suits are outside the scope of the regulations to address.

BLM Cost Recovery

Comments suggested that BLM require recovery of some or all of its administrative costs from the mineral operators as a way of funding the program. The issue of cost recovery is broader in scope than the 3809 regulations. Cost recovery may be addressed by a separate rulemaking for all programs, not just for locatable minerals.

Agency Funding and Staffing

Many comments noted that BLM does not have adequate funding and staffing to administer the program and that increases in the funding and staffing levels are the best way to address current problems. Aside from certain cost-recovery provisions (see above), agency funding and staffing levels cannot be established through regulations but are subject to congressional appropriation. While NRC noted that better implementing of the existing program presents the greatest opportunity for improving regulatory efficiency, the funding and staffing issue is outside the scope of the regulations to resolve. Nor does changing the regulations preclude BLM from pursuing regulatory efficiency. The EIS does include a discussion of the relative workload costs for implementing each alternative.

National Environmental Policy Act Processing of Plans of Operations

BLM received comments on how to conduct environmental review (environmental assessments or EISs) for Plans of Operations during scoping with regard to cumulative impact analysis, evaluating mitigating measures, and establishing EIS consultant qualifications. The NRC report emphasized continued reliance un the NEPA process and the early involvement of all stakeholders. The Council on Environmental Quality regulations at 40 CFR 1500 provide the requirements for implementing NEPA. Guidance on how to conduct environmental analysis for mining is more suitably developed through agency manuals or handbooks than by regulation, because of the evolving techniques in impact analysis and rapid technological developments in reclamation and mitigation.

Abandoned Mine Lands

One scoping comment stated that BLM lacks a consistent, nationwide review and approval process for abandoned mine land projects and that BLM should use the review process and performance standards in the 3809 regulations to review its own abandoned mine land projects. BLM does not consider this issue to be within the scope of the 3809 regulations. The technical requirements and capabilities of new or active mines under the 3809 regulations differ greatly from those of historic abandoned mines. Most abandoned mines that predate modern permitting regulations lacked the planning for eventual reclamation that goes into present-day mines and therefore are much more difficult to reclaim. The performance standards in the 3809 regulations rely on advanced consideration of eventual reclamation needs before mining begins in order to have practical application. It may not be technically or economically feasible to apply the 3809 performance standards to an abandoned mine that did not consider reclamation needs during its operation. The issue of a consistent review and approval process for abandoned mine lands has been forwarded to BLM's Abandoned Mine Lands Task Force for its consideration.

Diligent Development

Some comments noted that Notice- or Plan-level operations often sit idle for many years with only minimal work and that a diligence requirement should be included in the regulations. Requiring diligent mineral development as a prerequisite to maintaining mining claims is not considered within the scope of the 3809 regulations because the mining laws mention no time frame for mineral extraction. The mining laws focus instead on assessment work and claim maintenance fees. A discussion of the related issue of diligent reclamation and temporary or permanent closure of operations is included under Notices and Plans of Operations in Chapter 2.

Recreational Mining

Commenters stated that recreational mining was not intended under the mining laws since it did not result in commercial production. Establishing separate requirements to determine if a person is engaged in hobby versus commercial mining is not considered within the scope of the 3809 regulations. This determination would involve evaluating the economics of hobbyists working in areas open to recreational use anyway. Rather, the environmental effects of such concentrated activity are considered under the definition of casual use and alternatives considered for determining at what level of activity a Notice or a Plan of Operations should be required.

Public Availability of Information

Some comments suggested that all mine records be open for public review and that companies be required to disclose information on company finances, corporate officers, partners, directors, and compliance history. Much of this information may already be obtained from other government agencies such as the Securities and Exchange Commission. Most project-specific information that BLM receives may be obtained under the Freedom of Information Act, which applies to all BLM programs. A need for public disclosure requirements beyond existing authorities has not been established.

Combining 3809 Regulations with Occupancy Regulations

One comment suggested that BLM combine the 43 CFR 3715 regulations for mining claim occupancy with the 3809 regulations. Changes in the procedures for addressing occupancy have recently been addressed through regulation. A cross-reference with the 3715 regulations has been included in the proposed regulations to maintain consistency and improve user understanding.

Consistency with the Forest Service Regulations

Some commenters requested that both BLM and the Forest Service change their surface management regulations at the same time to promote consistency. Others said that BLM should not try to parallel Forest Service regulations. A joint revision effort requires Forest Service action. The NRC (1999) report concluded that the Forest Service and BLM need not have identical regulations that are uniform in all respects. Rather the report suggested changes that would make the agencies' approach to regulating hardrock mining more similar. It is beyond BLM's authority to change any of the surface management requirements for operations on lands administered by the Forest Service or to require the Forest Service to revise its regulations concurrently with BLM. The proposed regulations did consider adopting a threshold between a Notice and a Plan of Operations similar to current Forest Service regulations.

Chapter 2
Proposed Action and Alternatives

Significant Issues

The purpose of the alternatives is to allow the decision maker to consider ways to address and resolve issues recognized during the scoping process. The resolution of significant issues forms the framework of an alternative, with the resolution of lesser issues included around the alternative's central theme. This section describes how those significant issues led to the developing of the alternatives.

The development of alternatives centered on addressing regulatory issues in six general areas:

- Coordination between BLM and state regulatory agencies.
- Notice-Plan of Operations threshold.
- Defining performance standards.
- Financial assurance for performing reclamation.
- Regulation enforcement and penalties for noncompliance.
- Consistency with the National Research Council report (NRC 1999).

Although other relevant issues were considered, these significant issues played a major role in defining the alternatives to be analyzed in detail.

State-Federal Coordination

A significant issue consists of maintaining and improving coordination between the states and BLM and determining the relative level of responsibility for regulating mineral exploration and development. Alternatives developed to address this issue range from turning the program entirely over to state regulation to having BLM always assume the lead role for regulating mineral activities on public lands.

Some states and many industry representatives commented that the existing state-federal programs are adequate to regulate mining and that the existing regulations provide for the proper level of coordination to eliminate duplication. This position is reflected in Alternative 1, which would maintain the existing regulations.

Others commented that BLM regulation is redundant and not needed. Alternative 2 was developed to address these concerns. Alternative 2 would give the states the sole responsibility for day-to-day regulation and reduce BLM's role in regulation to periodic general oversight. State programs would meet the Federal Land Policy and Management Act (FLPMA) requirement of preventing unnecessary or undue degradation.

Alternative 3 was designed to give the option of deferring to state requirements for some, possibly large, portions of regulations while maintaining BLM concurrence authority on individual projects. This alternative would allow states to take the lead whenever possible yet maintain BLM's ability to regulate individual projects.

Some commenters expressed concern that anything less than a program of complete federal regulation of operations on federal lands would not adequately protect the environment. Alternative 4 addresses this concern with regulations that require BLM to play the lead role in all aspects of mining regulation on public lands. Although state regulations would still apply under Alternative 4, corresponding federal regulations would be at least as stringent and would guide the activity with design-based standards.

Alternative 5 would address comments that the existing system is working fine by leaving the state-federal coordination basically unchanged. At the same time, Alternative 5 would incorporate NRC's recommendation that BLM develop procedures for referring activities to the states for enforcement.

Notice or Plan of Operations (Plan) Threshold

Alternative 1 in this chapter describes the existing regulations' 5-acre threshold between when operations must submit Notices and when they must prepare Plans of Operations. Briefly, a Notice is required for surface disturbance of 5 acres or less during a calendar year, whereas a Plan of Operations is required for disturbance of more than 5 acres in a calendar year, or disturbance of any size exceeding casual use and occurring on special status areas.

BLM received a wide range of comments on this threshold. Some commenters wanted the threshold left as it is. Alternative 1 would not change the threshold and addresses this comment. Some commented that the requirements to file a Notice or Plan duplicated the filing requirements under state regulatory programs and were not needed. Eliminating the BLM filing and review requirements was included in Alternative 2 to address this issue.

Alternative 3 responds to comments that the current 5-acre Notice threshold is not always suitable, and to the recommendations of the NRC (1999) report. Alternative 3 would maintain the Notice provision but change the threshold from 5 acres of surface disturbance to a criterion based on mining versus exploration. Thus, operators proposing mines or collecting bulk samples exceeding 1,000 tons must file a Plan of Operations regardless of the acreage that would be disturbed, even if it is less than 5 acres. This approach responds to the comments that the Notice or Plan threshold should be driven mainly by the type of activity, not necessarily its size. Special status lands, where Plans of Operations are always required, have been expanded under Alternative 3 to address comments that sensitive lands and resources receive increased protection.

Some commenters were concerned that allowing operations to be conducted under a Notice would never be suitable because no National Environmental Policy Act review or opportunity for public involvement would be required. Alternative 4 addresses that concern by eliminating the Notice provision and requiring Plans of Operations for any surface disturbance exceeding casual use.

Alternative 5 is restricted to just implementing the NRC (1999) recommendations in response to comments that BLM should consider an alternative that would change the regulations only where NRC has recognized regulatory gaps. Alternative 5 responds to these comments and proposes a Notice-Plan threshold based on mining versus exploration, the same as Alternative 3. Because NRC did not recommend deleting the special status lands where a Plan is always required, Alternative 5 would retain the existing special status land categories.

Performance Standards

An important aspect of the 3809 regulations consists of the standards that govern how operators must control the extent of impacts on the ground. Alternatives were developed to address comments on the following:

- Environmental resources for which standards should be developed.
- Whether standards should be design or outcome oriented.
- Level of environmental protection the standards should give.

BLM could have developed and analyzed other combinations of standards. But the alternatives selected for analysis give a reasonable representative range of impacts to help agency decision makers. Every alternative includes compliance with other state or federal laws and regulations as a minimum performance standard.

Alternative 1 includes the existing performance standards. It also addresses comments that the existing regulations are adequate and that the regulations should contain minimum standards with details developed on an individual project basis or through policy guidance as needed to prevent unnecessary or undue degradation.

Alternative 2 contains no BLM performance standards but relies on state environmental regulations and other federal environmental protection requirements. This alternative addresses the comments that BLM performance standards are not needed because other state or federal requirements are adequate to protect the environment. State requirements vary from general outcome-based standards to prescriptive design standards, depending on the state program.

Alternative 3 proposes outcome-based BLM standards. These standards address the issue that, in addition to the state and other federal standards, BLM should have its own performance standards for operations on public lands.

The proposed standards are written to focus on performance and outcome, with minimum direction on design or required technology. This approach addresses comments that BLM should not develop one-size-fits-all design standards but allow for site-specific environmental conditions, promote innovation, and focus regulation on the end-performance result. This approach also addresses recommendations by the National Research Council that BLM should continue to use performance-based standards.

The Alternative 3 standards incorporate existing policy and practices into a comprehensive set of regulations that give more consistency. Alternative 3 does the following:

- Addresses the issue that BLM should consider ways to balance environmental protection with mineral development and not increase the regulatory burden on operators.
- Addresses comments by operators that BLM offices vary too much in applying existing regulations and policies.
- Incorporates the concept of preventing substantial irreparable harm to significant resources within the definition of unnecessary or undue degradation. This new definition responds to comments and the NRC conclusion that BLM should better protect the most significant resources on public lands from any impact.

Alternative 4 proposes standards that would address two common comments: (1) the need for increased environmental protection from mining and (2) the need for minimum national design standards for exploration, mining, and reclamation. The performance standards in Alternative 4 would require more stringent levels of environmental protection, coupled with design requirements, to attain those stated levels of protection.

Alternative 5 addresses the comments that NRC did not recommend more performance standards in its report. Alternative 5 therefore retains the performance standards in the existing regulations.

Financial Assurance (Bonding)

BLM received many comments on the adequacy of financial assurance requirements, generally referred to as bonding, and what these requirements should cover. Typically, bonding is required as a compliance tool to ensure that the required reclamation is performed should the operator be unable or unwilling to do so. With the recent district court case on BLM's 1997 bonding regulations, and the NRC report, the issue of reclamation bonding is even more relevant today than when the regulation revision process began. Alternatives for addressing the issue of bonding have been developed in response to comments.

Alternative 1 uses the existing regulations (those in effect before the February 1997 revisions) that give BLM the discretion to require reclamation bonding for Plan-level operations, with no set minimum or limit on the amount. Notice-level operations are not bonded. Alternative 1 addresses the comments that bonds should be held for larger operations or for operations in sensitive areas, where the risk is greatest. At the same time Alternative 1 addresses the comment that small-mine operators or persons engaged in exploration should be exempt from the bonding requirements because of the burden that bonding presents to the small operator and the small amount of surface that small operations disturb.

Alternative 2 provides for no reclamation bonding by BLM. Financial assurances would be required according to state requirements. This provision addresses the comment that bonding by BLM duplicates most bonding required under state programs and is not needed.

Alternative 3 requires bonding at the actual cost of the reclamation for all Notice- and Plan-level operations and would allow the public comment before final bond release. Bonding would include costs for interim stabilization and for post-reclamation treatment or maintenance such as water treatment, safety berms, and fencing. This provision addresses the public comments and NRC recommendation that all disturbances, no matter what size, should be fully bonded to protect the public.

Alternative 3 allows states to administer the bonding program to address the comment that BLM bonding duplicates state requirements and may impose an unneeded burden on operators. But BLM would have to agree to the bond amount and release.

Alternative 3 would also phase out the use of corporate guarantees as a form of financial assurance. This provision addresses comments that corporate guarantees are not secure if an operator files for bankruptcy and NRC's conclusion that financial assurance mechanisms should be secure.

Alternative 4 also requires that all operations be fully bonded for reclamation but further requires that added bond be posted for cleanup or remediation of unplanned events such as spills or failures. Alternative 4 addresses the comment that bonding solely for nonperformance of reclamation is not adequate but that bonding should be used to correct environmental damage from unplanned events.

Alternative 5 is basically the same as Alternative 3 in that all operations greater than casual use would be bonded for the full estimated cost of reclamation. Alternative 5 addresses comments that the regulations for bonding should be changed only in accordance with NRC's recommendations. Therefore, Alternative 5 does not include the procedural requirements for public notice on bond release, which are in Alternative 3.

Enforcement and Penalties

Alternative 1 provides administrative procedures, such as notices of noncompliance and possible court action, for unresolved noncompliance. This alternative responds to comments that enforcement is not a large problem and that BLM does not need new enforcement regulations because the states can handle existing problems.

Alternative 2 addresses the comments that BLM should leave most enforcement actions up to the states, eliminating a potentially duplicative process.

Alternative 3 would give BLM more enforcement tools, such as suspension and revocation authority and discretionary administrative penalties. This provision addresses three comments:

- BLM needs its own enforcement program for public lands rather than having to rely on going directly to court.
- A federal program is needed because some states are not always pursuing enforcement actions.
- NRC's recommendation that BLM should be able to issue administrative penalties for violations of its rules.

Alternative 4 provides more enforcement provisions than Alternative 3 by making administrative penalties mandatory, not subject to agency discretion, and by establishing permit blocks for noncompliance. This provision responds to those who feel that state enforcement programs are not strong enough and want a federal enforcement program with mandatory action required by BLM for noncompliance.

Like Alternative 3, Alternative 5 would address enforcement and penalties but would not cite criminal penalties because NRC did not recommend such penalties. Alternative 5 addresses comments that BLM limit any regulation change to just the NRC recommendations.

NRC Report Consistency

Congress directed that BLM could expend funds to finalize the proposed 3809 regulations during fiscal year 2000 only on final regulations that are "not inconsistent" with the recommendations in the NRC report. BLM considers that this requirement prohibits it from developing and selecting a final regulation alternative that would contradict or oppose a NRC recommendation during fiscal year 2000. Where NRC is silent on an aspect of the existing regulations, BLM-proposed changes would not be inconsistent with any NRC recommendations. In response to this requirement, BLM has modified Alternative 3, the proposed regulations, not to be inconsistent with the NRC recommendations.

Others have commented that the congressional requirement allows BLM to make only the regulation changes recommended by NRC and that any change in the regulations outside those recommended would be inconsistent with the NRC report. Alternative 5 has been developed to address this view.

Alternative 1–retention of the existing regulations–would be inconsistent with the NRC recommendations, but would not conflict with congressional requirements. Congress did not require BLM to change the regulations, only that should BLM make changes, they could not be inconsistent with NRC's recommendations.

Likewise, Alternative 2 would be inconsistent with the NRC recommendations because it would lessen many of the filing, bonding, and operating requirements in direct contradiction to many NRC recommendations.

Alternative 4 is also inconsistent with the NRC recommendations. Eliminating the Notice provisions and applying design-based performance standards would impose requirements much greater than those recommended by NRC as needed to protect the public lands.

Although Alternatives 1, 2, and 4 are not consistent with the NRC recommendations, they remain feasible alternatives. They address the program issues of concern to the public and could still be selected for implementing once the congressional limits on the contents of the final regulations expire.

Regulations Common to All Alternatives

Under all alternatives, national environmental protection laws and regulations apply to activities conducted under the Mining Law on BLM-managed lands. In addition, although local and state governments cannot impose land use planning or zoning restrictions on a federal land use such as mining, they can regulate how mineral activities are conducted. All of the western states have developed mining regulations that apply to activities on BLM-managed lands. As a result, mineral exploration and development are subject to compliance with a variety of local, state, and federal environmental laws and rules independent of any requirements imposed by the 3809 regulations. For example, major environmental laws such as the Clean Water Act, the Clean Air Act, the Endangered Species Act, the Migratory Bird Treaty Act, the Resource Conservation and Recovery Act, and the Archaeological Resources Protection Act apply to mineral activities under all of the alternatives.

Appendix C lists other applicable requirements, laws, or reviews. Appendix D discusses state programs that govern mineral projects under all alternatives. On this backdrop of other existing laws, regulations, and programs, and state regulatory programs, BLM considers the alternatives for applying the 3809 regulations.

Description of the Alternatives

This section describes in detail the five alternatives (including the Proposed Action and the No Action alternatives) that this EIS considers. Alternative 1 (Existing Regulations, No Action) would have BLM continue to use the existing 3809 regulations. Alternative 2 (State Management) would remove BLM from routine regulation of mineral activities and rely exclusively on the state programs to regulate mineral activities on BLM-managed lands. Alternative 3 (Proposed Action) contains BLM's proposed regulations, as revised after public comment. This alternative constitutes the BLM's Preferred Alternative. Alternative 4 (Maximum Protection) would increase the level of environmental protection and impose a design-oriented regulatory approach led by BLM. Alternative 5 (NRC Regulations) would change the regulations only where the NRC report recommends changes.

The five alternatives are described below in detail. Specific regulation language has not been drafted for Alternatives 2, 4 or 5. Should any of these alternatives be selected for implementation, BLM would prepare regulations to incorporate the concepts of the alternative. Following the detailed alternative descriptions is a discussion on the implementation costs for each alternative and a summary table (Table 2-1) that compares the major provisions of each alternative.

Alternative 1: Existing Regulations (No Action)

Alternative 1 would continue to use the existing surface management regulations at 43 CFR 3809 (Appendix A). These are essentially the same regulations that have been in effect since 1981. Over the years BLM has developed policy documents, manuals, and handbooks that give guidance on how the regulations are to be implemented. The following is a description of the existing regulations by major provision, along with a discussion of how BLM field offices are implementing the program.

Unnecessary or Undue Degradation Definition

The existing regulations require operators to prevent *unnecessary or undue degradation* of the public lands. Unnecessary or undue degradation (1) recognizes that locatable mineral activities cause environmental impacts and (2) seeks to keep those impacts at the minimal level needed for the operator to conduct activities as authorized under the mining laws. As defined in the existing regulations, unnecessary or undue degradation requires operators to do the following:

- Create no surface disturbance greater than would normally result from a prudent operator's performing the activity.
- Consider the effects of operations on other resources and land uses.
- Begin and complete reasonable mitigating measures, including the reclaiming of disturbed areas.
- Not create a nuisance.
- Comply with environmental statutes and regulations.

Project Area Definition

The existing regulations define a project area as a single tract of land upon which operations are conducted. The project area includes disturbance from building or maintaining roads, powerlines, pipelines, or other means of access. The definition specifies that the project area may include one or more mining claims under the same ownership. But in practice the project area often includes claims under multiple ownerships or may involve no claims if the land is open to activity under the Mining Law. BLM uses the working definition that the project area is the contiguous part of the same operation under the operator's control and includes disturbance for support facilities such as access roads, powerlines, or pipelines.

Public Lands/Federal Lands Definition

The definition of public lands determines to what lands the 3809 regulations apply. The existing regulations apply only to BLM-administered surface where the underlying mineral estate is subject to operations under the Mining Law. The existing regulations do not apply to lands where only the mineral estate is federal and the surface estate is privately owned, such as lands patented under the Stock Raising Homestead Act. Nor do the regulations apply to land whose surface estate is managed by BLM but whose mineral estate is privately owned. Locatable mineral activities on wilderness study areas (WSAs) administered by BLM are not regulated under the 3809 regulations but by subpart 3802, which is not part of this rulemaking.

Often locatable mineral operations occur on a mixture of private lands and BLM-administered lands. In these cases the 3809 regulations apply only to activities on the public lands. But if any associated environmental analysis is conducted under the National Environmental Policy Act, the analysis must consider the environmental impacts of the BLM approval on all lands, regardless of ownership.

Disturbance Categories and Thresholds

The existing 3809 regulations are based on three administrative classifications of surface-disturbing activities on public lands: casual use, Notices, and Plans of Operations.

Casual Use. Casual use refers to activities that only negligibly disturb public lands and resources. Casual use generally does not include the use of mechanized earth-moving equipment, explosives, or motorized equipment in areas closed to off-road vehicles. Some BLM field offices have considered the use of small suction dredges or portable drills to be casual use.

Operators engaged in casual use do not have to notify BLM of their activities, and BLM does not have to approve their operations. Casual use operations, however, are subject to monitoring by BLM to ensure against unnecessary or undue degradation. Disturbance created under casual use must still be reclaimed.

Notices. Activities that exceed casual use but disturb 5 acres or less during any calender year can be conducted under Notices unless special status areas are involved. A Notice is often used for exploration involving road building or drilling. Small mines can also operate under Notices. Notice-level activities may begin after a brief review by BLM for potential resource conflicts that would result in unnecessary or undue degradation. All disturbance created under Notices must be reclaimed. No more than 5 acres may remain unreclaimed at any given time, or the operator must obtain an approved Plan of Operations. Variations exist among BLM offices as to when reclamation is considered complete for determining acreage. One interpretation is that acres that have been graded and seeded are not counted, whereas other offices require reestablishing vegetation cover for acres that are not to be counted.

Plans of Operations. An approved Plan of Operations is required for surface disturbance that exceeds 5 acres, or for any surface-disturbing activity exceeding casual use in special status areas such as the following:

- The California Desert Conservation Area.
- Areas within or potential additions to the National Wild and Scenic Rivers System.
- Areas of critical environmental concern (ACECs).
- BLM-administered areas in the National Wilderness Preservation System.
- Areas closed to off-road vehicle use.

Claim Validity and Valid Existing Rights

The existing 3809 regulations do not address mining claim validity. In fact, the Mining Law does not require operators to have a mining claim or mill site before conducting operations on BLM lands. If the lands are open to locatable mineral activity under the Mining Law, operators do not need a mining claim to conduct operations.

On lands segregated or withdrawn from locatable mineral activity under the Mining Law, only in wilderness areas do the regulations (43 CFR 8560) require that mining claims be examined for validity before BLM approves Plans of Operations. In other segregated or withdrawn areas BLM can conduct validity examinations before processing Notices or approving Plans. But the time needed to complete the exam exceeds the 15-day Notice review time frame and would probably exceed the time needed for review and approval of a Plan of Operations. BLM can withhold authorization for Plans pending completion of a validity examination if a question arises as to a claim's validity.

Common Variety Minerals

Whether the mineral to be mined under a Notice or Plan is locatable under the Mining Law or saleable under the Materials Sales Act may be disputed. The existing 3809 regulations do not address this situation. The existing regulations (43 CFR 3610) prohibit the sale of mineral materials from mining claims even with agreement of the mining claimant.

The working policy has been (1) to process the Notice or Plan of Operations under the 3809 regulations and (2) to establish an escrow account. In this account the operator has to deposit monies representing potential fair market value should the mined material be found not to be locatable and such monies are owed the government. When BLM completes a common varieties determination (often a lengthy process), the escrowed royalty from ongoing operations is either returned to the operator or paid to the government. If the determination finds that the mineral is of common variety, BLM then converts the 3809 authorization to a material sale contract.

State-Federal Coordination

The existing 3809 regulations state that the rules do not preempt state laws and regulations governing operations on federal lands. The most protective regulatory provision usually applies. Appendix D summarizes state regulatory programs.

The existing regulations also allow BLM to enter into agreements with the states for joint regulatory program administration to prevent unnecessary or undue degradation and to eliminate duplication. Wherever possible, the agreements can allow state administration and enforcement of the program.

Under the existing regulations BLM has developed joint agreements for regulating operations in all of the western states except Arizona. Arizona and BLM are working on developing an agreement.

In states with laws similar to the National Environmental Policy Act (NEPA)–California, Montana, and Washington–BLM has based decisions on the environmental analysis prepared under both state and federal laws in consultation with state regulatory agencies. In other states that do not have statutes analogous to NEPA, BLM invites state and local agencies to participate in preparing environmental assessments and EISs, often designating state and local agencies as formal cooperating agencies.

Existing Operations

When the existing regulations went into effect in 1981, operations in existence were allowed to continue but were required to file either Notices or Plans of Operations, depending on the size of disturbance. Notice-level operations were required to file a Notice within 30 days of the effective date of the regulations. Operators required to file a Plan of Operations had to do so within 120 days but could obtain an extension of 180 more days. All operators required to file in 1981 have either done so or are no longer active.

Notice and Plan of Operations Content and Processing

Notices. No standard form is required for Notices, but Notices must adequately describe the activities that would occur and state that all disturbed areas will be reclaimed to the standards of the regulations. The operator must give the Notice to BLM at least 15 calendar days before beginning operations. BLM must complete its review of the Notice within 15 calendar days of receiving the complete Notice.

BLM's review of Notices is not a federal action, so no environmental documentation must be prepared under the National Environmental Policy Act. But a variety of BLM specialists do review Notices to determine if operations would cause unnecessary or undue degradation. The BLM minerals specialist reviews Notices to ensure that they are complete and that Plans of Operations are not needed. After the first review, other resource specialists conduct an interdisciplinary review of Notices for potential resource conflicts that would cause unnecessary or undue degradation.

The standards for reviewing Notices under the existing regulations and policy are as follow:

- Access routes must be planned for only the minimum width needed for operations and must follow natural contours, where practicable, to minimize cuts and fills.
- All tailings, dumps, and deleterious substances and other waste produced by operations must be disposed of to prevent unnecessary or undue degradation.
- At the earliest feasible time, operators must reclaim areas disturbed by taking reasonable measures to prevent or control on- and off-site damage to public lands.
- Reclamation must include saving topsoil to apply to the land's surface after disturbed

areas have been reshaped; taking measures to control erosion, landslides, and water runoff and to locate, control, and remove toxic materials; reshaping the disturbed area; applying topsoil; revegetating disturbed areas; and rehabilitating fisheries and wildlife habitat.

Other items are also reviewed:

- Verifying land status.
- Checking to ensure that the area is open to the Mining Law.
- Determining whether the operation would disturb 5 acres or less during a calendar year.
- Determining if the proposal covers the same ground as previous operations under another Notice.
- Recognizing potential conflicts with threatened and endangered species or cultural and paleontological resources.
- Recognizing potential compliance problems with state and federal laws. Often BLM inspects project areas with operators to detect and address areas of concern before disturbance.

Having reviewed the Notice, BLM informs the operator that public lands would or would not be unnecessarily or unduly degraded. This notification includes any changes and recommendations the operator needs to follow to prevent unnecessary or undue degradation and a statement reminding the operator that a final inspection of the reclaimed area is required.

Plans of Operations. No standard form is required for filing Plans of Operations. The operator must submit information, such as operator name and mailing address, a map or sketch of the operation, and enough information to describe the proposed operation and the reclamation measures to be used. BLM has 30 days to review a Plan of Operation and either approve it or advise the operator of the following:

- Of any other information needed to evaluate the Plan.
- Of measures required to prevent unnecessary or undue degradation.
- That more time, not to exceed 60 days, is needed for BLM to review the project.

If the Plan of Operations requires preparing an EIS, Section 7 consultation under the Endangered Species Act, or Section 106 compliance under the National Historic Preservation Act, then the review time is not limited.

A decision on a Plan of Operations is a federal action requiring analysis under the National Environmental Policy Act. The environmental analysis may be accomplished by several means. An environmental assessment (EA) or an EIS is the most common document prepared for approval of new or modified Plans of Operations.

The EA is used to determine if the operations would significantly affect the environment. If no significant impacts are found, a finding of no significant impacts and decision record (FONSI/DR) are prepared, and BLM approves the project if it would not create unnecessary or undue degradation. Operations that would cause significant impacts require preparing an EIS. (More guidance on elements that could trigger an EIS can be found in Department of the Interior Manual 516 DM 6, Appendix 5.)

A draft EIS is prepared to disclose potential impacts and consider mitigation measures. The public and other agencies then review the EIS. After a final EIS is written, BLM prepares a record of decision (ROD), subject to requirements to prevent unnecessary or undue degradation. The amount of time to prepare an EA or EIS and approve a Plan is determined by the complexity of issues and expected impacts of the project. Time frames can be as short as several days or extend for more than 5 years for large projects.

The technical issues involved in approving a Plan of Operations for large open pit and underground mines have become increasingly complicated. BLM has adopted policies to address such issues as the water quality of pit lakes, acid rock drainage, cyanide use, migratory bird deaths, reclamation and chemical closure, and mine dewatering. To standardize methods for addressing these issues BLM has developed the acid rock drainage policy, cyanide management policy, and BLM Reclamation Handbook. In addition, the 43 CFR 3715 Surface Occupancy Regulations address occupancy issues for nonmining surface use. BLM state offices such as Nevada have also adopted reclamation revegetation standard guidance and a water resource policy to further implement the national policy direction.

Modifications

Operators can modify Plans of Operations at BLM's request. BLM must review and approve a significant modification of an approved Plan just as it would the initial Plan.

BLM can require a modification only after the BLM state director determines (1) that the reasons for the modification were unforeseen at the time of the initial Plan approval and (2) that the modification is essential for preventing unnecessary or undue degradation.

Temporary or Permanent Closure

Reclamation is required. No time frame is specified for completing reclamation or for the time during which an operation may be temporarily closed before undergoing final reclamation.

Performance Standards

General. The existing regulation's overall performance standard is to prevent unnecessary or undue degradation. To comply with this standard, operators must do the following:

- Cause no impacts beyond those considered due and necessary.
- Reclaim disturbed land.
- Comply with all local, state, or federal environmental laws and regulations.

During individual project review BLM develops specific requirements for preventing unnecessary or undue degradation.

Land Use Plans. The existing regulations do not address the relationship of exploration and mining to land use planning. Land use plans may give information on resources requiring consideration by operators. BLM uses land use plans–such as resource management plans–to name special status areas that require Plans of Operations instead of Notices, such as areas of critical environmental concern. The land use plan also determines where BLM would seek withdrawals of lands from operation of the Mining Law. But if the land is open to mineral entry, the existing 3809 regulations, not a particular land use plan, establish performance standards for operations.

Surface and Ground Water Protection. All operators must comply with federal and state water quality standards. National Pollution Discharge Elimination System (NPDES) permits are required from the Environmental Protection Agency (EPA) or a state-delegated authority by EPA for a discharge to surface water. In addition, some states require discharge permits for ground water.

Lakes that form in mine pits are generally not regulated under the NPDES system. In some states if the pit lake discharges to ground water, a permit may be required. BLM uses predictive modeling to estimate pit lake geochemistry and potential toxicity. Pit lakes found to be potentially toxic must be treated, eliminated, or restricted from access.

The existing regulations do not specify requirements for plugging drill holes. Field offices have been requiring plugging in response either to state requirements or to site-specific ground water concerns.

Wetlands and Riparian Area Protection. The existing regulations do not specify protection of wetland or riparian areas but require wildlife and fisheries habitat to be rehabilitated. Rehabilitating these habitats does add some protection to wetland and riparian areas. Section 404 permits, required by the Army Corps Engineers for dredging or filling in waters of the United States, provide for mitigating impacts to jurisdictional wetlands.

Soil or Growth Media Handling. The existing regulations require that operations save and reapply topsoil to disturbed areas where reasonable and practicable after reshaping disturbed land. The existing regulations do not specify requirements for segregating or preserving topsoil.

Revegetation Requirements. The existing regulations require revegetation of disturbed areas where reasonable and practicable. Revegetation must provide a diverse vegetation cover. Common practice is for most BLM field offices to review the operator's proposed seedmix. Revegetation is also a part of the requirement to rehabilitate wildlife habitat. The requirement in the definition of "unnecessary or undue degradation" not to create a nuisance is used to address noxious weed control.

Fish and Wildlife Protection and Habitat Restoration. The existing regulations require operators to act to prevent harm to threatened and endangered species and their habitats that might be affected by operations. An unmitigatable impact to a threatened or endangered species is one of the few resource conflicts that can prevent a Plan of Operations from being approved or a Notice-level operation from proceeding.

The existing regulations require that reclamation include rehabilitating fisheries and wildlife habitat. The regulations do not specify a time frame for achieving rehabilitation.

Protecting Cultural Resources. A Decision on a Plan of Operations requires BLM to follow the process in Section 106 of the National Historic Preservation Act to develop mitigation for cultural resources recognized before a Plan is approved. Since a Notice is not a federal undertaking, the Section 106 process does not apply. But BLM field offices review Notices and often visit project areas, instructing operators on avoiding cultural resources.

The existing regulations state that operators cannot knowingly disturb, alter, injure, or destroy any historical or archaeological site, structure, building, object, or cultural site discovered during operations. If a significant discovery is made during operations, the regulations require operators to immediately notify BLM and to leave such discovery intact. BLM has 10 working days to protect or remove the discovery at the government's expense, after which operations may proceed.

Protecting Paleontological Resources. The existing 3809 regulations do not contain a process for inventory and evaluation of paleontological resources like the procedures for cultural resources under the National Historic Preservation Act. The existing regulations state that operators cannot knowingly disturb, alter, injure, or destroy any scientifically important paleontological remains. Operators must immediately notify BLM of any paleontological resources discovered during operations and leave such discoveries intact. BLM has 10 working days to protect or remove the discovery at the government's expense, after which operations may proceed.

Protecting Cave Resources. The existing regulations do not specify performance standards for protecting cave resources. When operations would potentially harm cave resources, BLM considers them under the general requirements to prevent unnecessary or undue degradation.

Protecting American Indian Traditional Cultural Values, Practices, and Resources. The existing regulations do not specify performance standards for protecting American Indian traditional cultural values, practices, and resources. Often these resources are also historic properties that must be considered under the National Historic Preservation Act (NHPA). But NHPA does not prevent the disturbance of cultural resources. Rather, it provides a process for considering potential impacts and developing mitigation.

BLM must also consult with American Indians under other acts such as American Indian Religious Freedom Act (AIRFA). Consultation does not preclude the activity but allows discussion for developing mitigation. BLM has extensively consulted with American Indians on mine projects, and American Indians have often said that impacts to traditional cultural values, practices, and resources cannot be mitigated.

Roads and Structures. The existing regulations require an operator to do the following:

- Minimize surface disturbance.
- Use existing access where practical.
- Maintain safe design.
- Follow natural contours.
- Minimize cuts and fills.

Operators must consult with BLM for roadcuts greater than 3 feet on the inside edge. All structures must be built and maintained according to state and local codes. Placing structures is addressed in separate rules at 43 CFR 3715.

Handling of Potentially Acid-Forming, Toxic, or Other Deleterious Materials. The existing regulations state that reclamation must include measures to isolate, remove, or control toxic or deleterious materials. BLM imposes other requirements in response to the site-specific review when processing a Notice or Plan.

In the past decade more deeper, sulfide-bearing ores have been mined. As a result, acid rock drainage (ARD) has become an issue of concern for BLM when reviewing mining proposals. In 1992 BLM issued its acid rock drainage policy (Instruction Memorandum 96-79). This policy directs field offices to do the following:

- Review mining proposals for ARD potential.
- Require rock characterization.
- Emphasize source control of potentially acid-generating materials rather than treating effluent.
- Inspect operations at least quarterly.

Leaching and Processing Operations and Impoundments. The existing regulations do not refer to cyanide or other chemicals used in mineral processing or leaching. The regulations do require that reclamation include measures to isolate, remove, or control toxic or deleterious materials. BLM develops mineral leaching requirements during site-specific reviews while processing Notices and Plans.

In response to the increase in cyanide use on BLM-managed lands, BLM issued a cyanide management policy (Instruction Memorandum 90-566) in 1990. The policy guides field offices in managing cyanide operations by requiring BLM state offices to prepare cyanide management plans and by setting minimum standards for cyanide facility design, wildlife protection, monitoring, and quarterly agency inspections.

Stability, Grading, and Erosion Control. The existing regulations require reclamation to include reshaping disturbed areas where reasonably practicable and using measures to control erosion, landslides, and water runoff. A required slope angle or outcome is not specified for reshaping.

Pit Backfilling and Reclamation. The existing regulations do not specifically address mine pit backfilling but require that disturbed areas be reshaped "where reasonably practicable." The existing regulations also allow a stable highwall to be left where required to preserve evidence of mineralization but do not mention a time frame.

BLM field offices have dealt with pit backfilling on a project-specific basis, usually negotiating with operators for mitigation where backfilling a pit mine is uneconomic or infeasible. Sometimes offsite mitigation compensates for habitat lost to mining pits. Occasionally BLM has determined that backfilling is practical and has required partial backfilling or backfilling at sequential open pit mines.

Financial Guarantees (Bonding)

The existing regulations require reclamation bonds only for Plan-level operations with the amount left to BLM's discretion. No financial guarantees or reclamation bonding is required for Notice-level operations (except for Notice-level operators with records of noncompliance).

BLM has implemented several policies for bonding. Recently, reclamation bonds were limited to $1,000 per acre for exploration disturbance and $2,000 per acre for mining disturbance, except for cyanide facilities or portions of operations with acid rock drainage potential, which were to be bonded at actual cost. The instruction memorandum that established the aforementioned bonding policy has expired, but some BLM field offices may still implement it.

As part of state-federal coordination, operations are bonded in cooperation with the state regulatory agencies to prevent double bonding of operators. Bonding varies from state to state. For example, in Nevada BLM holds the bond for the State of Nevada. In Montana the state holds the bond for operations on BLM lands.

Inspection and Monitoring

BLM develops monitoring programs while reviewing Notices and Plans of Operations. The operator conducts environmental testing (water, air, soil, etc.) and submits the results to BLM. BLM may take samples during inspections to verify that the monitoring data is reliable.

Operators must allow BLM to inspect operations to determine compliance. Current policy is for inspections four times annually where cyanide is used or where a significant potential exists for acid rock drainage, and two inspections per year for all other active operations.

BLM works with operators when they are not complying with federal and state laws and regulations. If these cooperative efforts yield no results, BLM issues a notice of noncompliance. If the operator still fails to comply, BLM may take other measures:

- Requesting help from federal or state regulatory agencies.
- Issuing records of noncompliance.
- Forwarding the case to the Department of the Interior Regional Solicitor and the Justice Department.

Penalties for Noncompliance

Under policy developed for the existing regulations, if an operator does not comply with a notice of noncompliance, BLM may establish a record of noncompliance. Operators with records of noncompliance must (1) file Plans of Operations for activities that would otherwise be conducted under Notices and (2) post a reclamation bond with BLM even if they have already posted a bond with the state. In other cases the courts may forbid unlawful activities and impose penalties for damages or violations of the 3809 regulations and the Federal Land Policy and Management Act.

Appeals Process

The existing regulations contain two processes by which BLM decisions may be appealed, depending on whether the operator or another party is appealing. All appeals must be filed within 30 days of a decision.

Operators that are adversely affected and want to appeal must appeal to the BLM state director. The state director then decides on the appeal. Operators adversely affected by a state director's decision may appeal that decision to the Interior Board of Land Appeals (IBLA). Anyone other than the operator that is adversely affected may appeal BLM's decisions directly to IBLA. BLM's decision is in full force and effect during an appeal before either the state director or IBLA. A stay from the effect of the decision may be granted while the appeal is pending.

State directors usually make decisions on appeals within several weeks or months. Appeals to IBLA take much longer. The current backlog in IBLA for a routine appeal is about 3 years. IBLA usually responds to requests for stays within 6 months. If IBLA grants a case expedited consideration, it may decide the case in less than a year.

Alternative 2: State Management

Under Alternative 2 BLM would defer regulating exploration and mining to the states. The 3809 regulations would define *unnecessary or undue degradation* to mean failure to meet all local, state, and federal laws and regulations for conducting exploration and mining. (Appendix D summarizes state regulatory programs.) BLM would develop no other rules.

BLM would neither review nor approve of any specific project. Nor would any federal decision or undertaking be subject to National Environmental Policy Act (NEPA) review or compliance with Section 106 of the National Historic Preservation Act (NHPA). Although they would still have to comply with federal laws such as the Clean Water Act and Endangered Species Act, mineral operations would not be regulated by BLM.

In accord with the Federal Land Policy and Management Act (FLPMA), BLM would continue to prepare land use plans to determine areas to be opened or closed to operations under the Mining Law through the withdrawal process. State regulators could also use land use plans for information on special management concerns in areas open to operations. BLM would continue to process mineral withdrawals and examine mining claims for validity to meet its land management objectives. But BLM would not be involved in day-to-day regulation of operations.

Unnecessary or Undue Degradation Definition

The 3809 regulations would define *unnecessary or undue degradation* to require only that the operator meet all local, state, and federal laws and regulations. Compliance with state programs for regulating mining would be considered adequate for preventing unnecessary or undue degradation as required by FLPMA.

Project Area Definition

Project areas would be defined according to state programs. Any exclusive use of access roads, powerlines, pipelines, etc. would require rights-of-way from BLM.

Federal Lands Definition

The definition of federal lands would not change.

Disturbance Categories and Thresholds

The disturbance categories used under the existing regulations would not apply under Alternative 2 because operators would not have to file Notices or Plans with BLM. BLM would have no category or threshold classification. The state would be responsible for all permitting of activities on BLM lands under state categories.

Claim Validity and Valid Existing Rights

Claim validity and valid existing rights under Alternative 2 would not change from the existing regulations. BLM would exercise its option of examining a mining claim when needed to protect resources.

Common Variety Minerals

The existing regulations would not change for common variety minerals. BLM would require an operator suspected of mining common variety minerals to place possible fair market value in escrow until after BLM completes a common variety determination. BLM might seek a court order to stop operations if the monies are not escrowed.

State-Federal Coordination

States would regulate all mineral activity on BLM lands. BLM would periodically evaluate the state program to determine if it is preventing undue or unnecessary degradation.

BLM would also continue to use the land use planning and withdrawal process to decide which areas are open or closed to mining. BLM would give comments and input to states during their review and approval process for activity on BLM-administered lands. BLM's role would be that of a land owner.

Existing Operations

Existing activity would continue according to state requirements.

Notice and Plan of Operations Content and Processing

Operators would submit no Notices or Plans of Operations to BLM for review or approval but would follow state program requirements for content and processing of activities. BLM would not process applications, conduct project-level National Environmental Policy Act analysis, or make decisions. As a potentially affected landowner, BLM might give the states comments on individual actions.

Modifications

Modifications made to operations would be required, reviewed, and approved according to individual state requirements.

Temporary or Permanent Closure

Closure requirements and time frames would be determined by state regulations. Operations abandoned under a state program might be eligible for reclamation under the BLM abandoned mine lands program.

Performance Standards

General. Performance standards would be based on state standards and requirements. The state standards for air, water, wildlife, reclamation, and other resources would be the controlling standards for operations on public lands. Other federal requirements such as the Endangered Species Act would continue to apply under the administration of the responsible federal agency.

Land Use Plans. BLM would retain all responsibility for preparing land use plans, designating special status areas, and determining areas open or closed to the operation of the Mining Law.

Surface and Ground Water Protection. All activities would be conducted according to state and federal water quality laws or the state program delegated under the Clean Water Act.

Wetlands and Riparian Area Protection. Operators would have to comply with state requirements and obtain permits from the Army Corps of Engineers for dredging or filling in waters of the United States under Section 404 of the Clean Water Act.

Soil or Growth Media Handling. Topsoil would have to be salvaged and reapplied according to state standards.

Revegetation Requirements. Disturbed areas would have to be revegetated according to state standards.

Fish and Wildlife Protection and Habitat Restoration. Operations would have to meet state standards for protecting fish and wildlife. The taking of a threatened or endangered species or migratory birds would still be prohibited under the Endangered Species and Migratory Bird Treaty Acts.

Protecting Cultural Resources. Operations would have to meet state standards for protecting cultural resources.

Protecting Paleontological Resources. Operations would have to meet state standards for protecting paleontological resources.

Protecting Cave Resources. Operations would have to meet state standards for protecting cave resources.

Protecting American Indian Traditional Cultural Values, Practices, and Resources. State standards for protecting American Indian traditional cultural values, practices, and resources would have to be met. American Indians could request help from BLM to facilitate consultation with the state on a project's potential impacts. The Secretary of the Interior's trust responsibilities would continue, but BLM would not be in a position to require mitigation.

Roads and Structures. Roads would be built and maintained according to state standards and state and local codes. Structures are addressed in separate rules at 43 CFR 3715.

Handling of Potentially Acid-Forming Toxic or Other Deleterious Materials. Potentially acid-forming material would be managed according to state requirements. Discharges could not exceed state and federal effluent limits under the Clean Water Act.

Leaching and Processing Operations and Impoundments. Leaching and processing operations would have to be designed, built, and operated according to state standards.

Stability, Grading, and Erosion Control. Stability, grading, and erosion control would have to be accomplished according to state regulations.

Pit Backfilling and Reclamation. Mine pits would be backfilled or reclaimed according to state requirements.

Financial Guarantees (Bonding)

No BLM bonding would be required. States would set, hold, and administer any financial guarantees under state regulations. Existing reclamation bonds filed with BLM would either be returned to operators or transferred to the states.

Inspection and Monitoring

States would conduct inspection and monitoring programs for compliance with state regulations. BLM could inspect sites to verify that lands are not undergoing unnecessary or undue degradation.

Penalties for Noncompliance

States would use their own enforcement and penalty programs for noncompliance. BLM would take no more enforcement action. Other agencies (Environmental Protection Agency, Fish and Wildlife Service) could still issue citations for violation of environmental laws under their statutory authorities.

Appeals Process

Alternative 2 would have no appeals process on project approvals or enforcement through BLM because a federal action would not normally be involved. Should BLM act under other regulations such as for rights-of-way, the decision could be appealed as provided by regulations.

Alternative 3: Proposed Regulations (Proposed Action and Preferred Alternative)

The proposed regulations would replace the existing regulations at 43 CFR 3809. This alternative constitutes BLM's preferred alternative. The regulations have been changed from those presented in the draft EIS in response to public comments and so as not to be inconsistent with the NRC (1999) report.

Unnecessary or Undue Degradation Definition

The proposed regulations would change the existing definition of unnecessary or undue degradation. The regulations would replace the "prudent operator" standard in the existing regulations with the requirement to comply with the following:

- Performance standards of the proposed regulations.
- Terms and conditions of approved Plans of Operations or Notices.
- Other federal or state laws for environmental protection.

The proposed definition also incorporates the Surface Use Act (PL 69-167) requirement that activities be reasonably incident to prospecting, mining, or processing. The definition would retain the current requirement that operations attain the stated level of protection or reclamation required by specific laws in areas such as the California Desert Conservation Area, wild and scenic rivers, wilderness areas, national monuments, or national conservation areas.

The definition of *unnecessary or undue degradation* has been changed in the final proposed regulations to include: "...conditions, activities, or practices that...result in substantial irreparable harm to significant scientific, cultural, or environmental resource values of the public lands that cannot be effectively mitigated." This definition means that operations would not be allowed where significant resources would incur substantial irreparable harm that could not be mitigated. Although BLM intends that a denial based upon this aspect of the definition would rarely be invoked, BLM would review all operations for such potential impacts.

Examples of where this requirement *may* apply include the following:

- Disturbance of American Indian sacred sites.
- Activity that would affect proposed species to the point they would become listed as threatened or endangered.
- Mining that removes critical water supply aquifers.
- Disturbance of extremely acid generating material that could not be effectively controlled.

This is not an exhaustive list but gives examples of where the resources are significant and the impact would be so great as to constitute unnecessary or undue degradation under the proposed definition.

Project Area Definition

The proposed regulations would change the definition of the project area to account for the possibility that mining claims in a project area might be held by more than one owner. All access and support facilities are still included in the definition.

Public Lands Definition

The scope of the proposed regulations and the definition of public lands would expand the category of lands on which the 3809 regulations would apply. The proposal is to include split-estate lands patented under the Stock Raising Homestead Act, where the surface is private but the mineral estate is reserved to the United States and open to operations under the Mining Law.

The proposed regulations would also apply to lands where the surface has been sold or exchanged but the minerals have been reserved to the United States. On these lands the minerals are now segregated from location under the Mining Law until the Secretary of the Interior issues regulations. The proposed final regulations would be the regulations needed before these lands could be open to operation under the Mining Law. But adopting the proposed regulations would not result in a wholesale opening of all these reserved minerals. The regulations are written to require land use planning decisions and environmental analysis before BLM decides to open tracts to operation under the Mining Law.

Disturbance Categories and Thresholds

Casual Use. The proposed regulations retain the category of casual use for activities that involve collecting geochemical, rock, soil, or mineral samples using hand tools, hand panning, and nonmotorized sluicing. Casual use would not include the use of mechanized earth-moving equipment, truck-mounted drilling equipment, chemicals, explosives, or motorized vehicles in areas closed to off-road vehicles.

The proposed definition of casual use would allow some small suction dredging but would exclude operations whose cumulative effects would result in more than negligible disturbance. The BLM state director may establish areas where people or groups wishing to engage in casual use activities must inform BLM in advance so BLM can determine if a Notice or Plan of Operations is required because of the potential for cumulative effects to exceed negligible disturbance.

Suction dredge operators may be required to contact BLM to determine if the proposed activity may proceed as casual use, or if a Notice or Plan of Operations will be required. The suction dredge operator would not be required to contact BLM if (1) the state requires an authorization for suction dredging and (2) BLM and the state have an agreement under proposed 3809.200 for BLM to accept state authorizations for purposes of regulating suction dredging on BLM-administered lands.

Notices. The proposed regulations would allow only exploration operations to file Notices. This provision changes the existing regulations, which allow an operator to file a Notice if less than 5 acres is disturbed and the site disturbed is not in a special status area. This change was made so that the regulations would not be inconsistent with the NRC (1999) recommendations.

Plans of Operations. The final regulations were changed so as to not be inconsistent with the NRC recommendations. The Plans of Operations threshold would require Plans of Operations for any mining regardless of size and for any exploration involving bulk sampling of more than 1,000 tons. This limit replaces the existing threshold that requires Plans of Operations for more than 5 acres of disturbance.

In addition, the proposed regulations would expand the types of special status lands—where Plans of Operations would be required for any disturbance exceeding casual use, including exploration. Two new types of public land areas would be added as listed under the regulations at 3809.11(c): any lands or waters known to contain federally proposed or listed threatened or endangered species or their habitat, and national monuments and national conservation areas. In addition, Plans of Operations would be required for activity on private surface over reserved federal minerals where operators do not have the consent of surface owners.

Claim Validity and Valid Existing Rights

The proposed regulations require validity exams to determine valid existing rights before BLM approves a Plan of Operations or allows Notice-level operations to proceed in areas withdrawn from the operation of the mining laws. On segregated lands, such as those to be exchanged, sold, or selected by a state, BLM may require a validity exam to determine valid existing rights before BLM approves a Plan of Operations or allows Notice-level operations to proceed in these areas. This change would incorporate in the regulations what had previously been within BLM's discretion.

Common Variety Minerals

The proposed regulations incorporate a process that has been in general practice for minerals that are under dispute as to being locatable under the Mining Law or of common variety and therefore saleable and subject to sale for fair market value. The proposed regulations would allow mining of the material under a Plan of Operations subject to the operator's placing potential fair market value in escrow pending the outcome of a common varieties determination by BLM.

The proposed regulations would also allow BLM to sell mineral materials from an unpatented mining claim with the written consent of the claimant.

State-Federal Coordination

The proposed regulations would enable the establishing of two types of agreements between BLM and the state: (1) an agreement that allows joint administration of the regulatory program or (2) an agreement where BLM defers to state administration some or all of the program. An important provision of the proposed regulations is that if BLM determines that the state program is adequate to meet the BLM equivalent, then BLM must give the state the lead for regulation if the state requests the lead.

Even with a complete deferral to state regulation, the proposed regulations would require BLM to retain the following:

- Concurrence on approval of Plans of Operations.
- Analysis responsibilities under the National Environmental Policy Act.
- Concurrence in the approval and release of any financial guarantee.
- Consultation and coordination duties for compliance with the National Historic Preservation Act and the Endangered Species Act.
- Responsibility for any government-to-government consultation with American Indian tribes.

BLM would also retain the option to conduct inspections and take enforcement actions.

Regardless of the cooperative agreement in place, BLM would always retain responsibility for land use planning for BLM-managed lands. The state could not restrict land use on BLM-managed lands, only regulate the activity authorized by the public land laws.

Existing Operations

The proposed regulations, if adopted, would be applied to existing or pending Notices and Plans of Operations as follows:

Existing Notices would expire after 2 years. Operators choosing to continue operations beyond the 2-year period would have to extend their Notices by providing an acceptable financial guarantee. Notices for mining would not be required to refile as a Plan of Operations if the disturbance area does not increase.

Any approved Plans of Operations existing on the effective date of the regulations could continue as originally approved for Plan content and performance. Plans of Operations, or Plan modifications, pending before BLM on the effective date of the regulations would not have to meet the new Plan content, new performance standards, or new definition of unnecessary or undue degradation.

Other aspects of the proposed regulations such as enforcement provisions and bonding would apply to all Plans of Operations. Existing operations would have to give the required financial guarantee within 180 days of the effective date of the regulations if their present financial guarantees do not meet the requirements of the final regulations.

New mine facilities added to existing Plans of Operations would be required to comply with the new regulations. Modifications to mine facilities originally approved under the existing regulations would be required to comply with the new Plan content and performance standards unless the operator shows that compliance is not practical for economic, environmental, safety, or technical reasons.

Notice and Plan of Operations Content and Processing

Notices. The proposed regulations would make it explicit that the 15-day time for BLM to review a Notice does not begin until BLM receives a "complete" Notice. The proposed regulations would retain the 15 calendar day review time frame, instead of the initially proposed 15 work days because Notices could be used only for exploration. This amount of time would generally be enough for BLM to conduct the review of exploration operations. But if conditions warrant, the regulations would allow 15 more days of review and an opportunity for BLM to conduct a site visit, before completing its review of the Notice.

The proposed regulations contain more detail on the contents of a Notice. But operators are already providing most of this information in Notices under the existing regulations. One addition is the requirement to give a reclamation cost estimate. The proposed regulations contain a new requirement that all Notice-level operations must give a financial guarantee to ensure performance of reclamation (see section on financial guarantees) and that the operator must prepare the initial reclamation cost estimate.

BLM would not approve a Notice but would review it for adequacy in preventing unnecessary or undue degradation.

Plans of Operations. The proposed regulations would require Plans of Operations to contain information on the operator; a description of the operation; and the operation's reclamation, monitoring, and interim management plans. These requirements mostly formalize existing practices. The proposed regulations would further require operators to supply baseline environmental data on a site-specific basis as specified by BLM. Such data is not required under the existing regulations, but many larger operations have routinely given it to facilitate National Environmental Policy Act (NEPA) compliance.

Operators would be required to give BLM an initial reclamation cost estimate. BLM would review the estimate and either request more information or notify the operator of the final amount for which financial assurance must be provided.

The proposed regulations would specify that operators submit a complete proposed Plan of Operations. The Plan must describe the operation in enough detail for BLM to complete its review and determine if the Plan would be adequate to prevent unnecessary or undue degradation.

The final regulations would require that all Plans of Operations be released for at least a 30-day public comment period. This comment period would generally be the same as the comment period for the environmental analysis prepared under NEPA.

The regulations would also specify that BLM could disapprove or withhold approval of a Plan of Operations if it does not meet content requirements. BLM could disapprove a Plan of Operations that proposes operations in an area closed to the Mining Law, or if the operation would result in unnecessary or undue degradation. If it disapproves a Plan of Operations because it would result in substantial irreparable harm to significant resources, BLM must include written findings stating how each element is exceeded and therefore warrants Plan disapproval.

Modifications

The proposed regulations would allow BLM to require modification where needed to prevent unnecessary or undue degradation and before mine closure to address unexpected events or conditions. This provision changes the existing regulations, which allow BLM to require a modification only if the state director determines that the circumstances warranting modification were unforeseen during initial Plan approval.

Temporary or Permanent Closure

The proposed regulations establish criteria for temporary and permanent closure, requiring operators to file interim management plans as part of their Plans of Operations. Operators are then required to do the following:

- Follow this plan if they stop conducting operations.
- Take all needed action to prevent unnecessary or undue degradation.
- Maintain an adequate financial guarantee.

After 5 consecutive years of inactivity BLM will review an operation and may terminate the Plan of Operations if it finds the operation to be abandoned. BLM will then direct final reclamation and closure.

Performance Standards

General. The proposed regulations contain mainly outcome-based performance standards. Instead of specifying a particular design, these standards describe the resource condition that must be achieved or the performance a particular operating component must meet. The proposed regulations require that the operator use equipment, devices, and practices that will meet the performance standards.

The proposed regulations also contain a performance standard that requires the operator to follow a reasonable and customary sequence of operations. This means that certain types of disturbance, such as mining, should be preceded by exploration in order to establish that the mining disturbance is necessary. This requirement is not specified in the existing regulations but is implied under the term *unnecessary or undue degradation*.

Land Use Plans. The proposed regulations require operations and postmining land use to comply with land use plans. This requirement also recognizes that the land use plans must not impair the rights of claimants under the Mining Law. BLM cannot use land use plans by themselves to preclude mineral activity, but should use them for guidance on regulating the activity. This performance standard is not intended to replace the withdrawal process for removing lands from operation of the Mining Law.

Surface and Ground Water Protection. All operations would have to comply with state and federal laws and regulations protecting water quality and quantity. The proposed regulations would require that the water quality of a mine pit not endanger wildlife, public water supplies, or users.

For water pollution and dewatering, the proposed regulations would require that operation and reclamation minimize water pollution and changes in flow in preference to water treatment or replacement. Specifying a preferred approach, this standard is an exception to the general statement that the performance standards under Alternative 3 are outcome based.

The proposed regulations contain requirements for exploration drilling and drill hole plugging. Drill cuttings and mud would have to be contained onsite. All exploration drill holes would have to be plugged to prevent the following:

- Mixing of waters from aquifers.
- Adverse impacts to beneficial uses.
- Downward water loss.
- Upward water loss from artesian conditions.

The surface would have to be plugged to prevent the direct inflow of surface water into the borehole and to eliminate the open hole as a hazard.

Wetlands and Riparian Area Protection. Both the existing and proposed regulations require that operators obtain state and federal permits for dredging or filling in waters of the state or the United States. Included are the Section 404 permits under the Clean Water Act issued by the U.S. Army Corps of Engineers (COE) with certification by the state water quality agency. No COE permits are required for riparian areas that do not fall within the ordinary high water mark and therefore are not COE jurisdictional waters.

The proposed regulations would build on the current Clean Water Act permitting requirement by specifying a site-selection hierarchy for both wetlands and riparian areas. The proposed regulations would require that disturbance either (1) avoid wetland and riparian areas or (2) minimize impacts to wetlands and riparian areas and mitigate damage to wetland and riparian areas through measures such as restoration or offsite replacement.

Soil or Growth Media Handling. The proposed regulations would require that topsoil or other growth media be removed from the lands disturbed by operations and segregated and preserved for later use in revegetation during reclamation. Where feasible, the proposed regulations would direct transport of topsoil from the salvage site to use in reclamation to preserve more of the soil's fertility.

Revegetation Requirements. The proposed regulations would require that all disturbed lands be revegetated to establish a stable and long-lasting vegetation cover that is self-sustaining and comparable in both diversity and density to preexisting natural vegetation. Native species would be used to the extent feasible, and disturbed land would be revegetated according to the schedule in the reclamation plan. The proposed regulations would also require operations to be managed to prevent the introducing of noxious weeds and to control existing infestations.

Fish, Wildlife, and Plant Protection and Habitat Restoration. The requirements from the existing regulations would be carried forward to the proposed regulations. Operators would have to prevent harm to threatened or endangered species and their habitats. Fisheries and wildlife habitat disturbed would have to be rehabilitated as part of reclamation.

The proposed regulations would also require operators to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values. All processing solutions, reagents, or mine drainage that might be toxic to wildlife would have to be fenced or netted to prevent wildlife access. Previously, fencing and netting had been required by policy and incorporated during project-specific reviews.

Protecting Cultural Resources. Section 106 of the National Historic Preservation Act would continue to be used to develop mitigation for historic properties found before a Plan of Operations is approved. The proposed regulations would also require that operators not knowingly disturb, alter, injure, or destroy any historical or archaeological site, structure, building, or object discovered during operations. These discoveries would be left intact, and the operator would immediately notify BLM of the discovery so that BLM could decide on proper means of data recovery or salvage.

The proposed regulations would require operations to cease for 30 days to allow for data recovery of discovered cultural resources. This period is an increase over the existing requirement of 10 business days. The proposed regulations would also allow BLM to determine who bears the cost of recovery instead of assuming that the government would pay the cost.

Protecting Paleontological Resources. The proposed regulations for protecting paleontological resources would be similar to regulations for cultural resources except no formal consultation process would be required like that under the National Historic Preservation Act (NHPA). The proposed regulations would require operations to cease for 20 business days to allow data recovery of discovered paleontological resources. This period is an increase over the existing requirement of 10 business days. The proposed regulations would also allow BLM to determine who bears the cost of recovery instead of assuming that the government would pay the cost. If BLM were to incur such costs, the proposal could allow BLM to then recover these costs from the operator, according to Section 304(b) of the Federal Land Policy and Management Act.

Protecting Cave Resources. The proposed regulations would add a new requirement to protect cave resources through identification and mitigation plans before disturbance. Should cave resources be discovered, the proposed regulations would require operations to stop for 20 business days to protect or preserve the resource. BLM would determine who bears the cost of cave protection.

Protecting American Indian Traditional Cultural Values, Practices, and Resources. The proposed regulations do not specify performance standards for these resources. The existing process of consultation and mitigation described for Alternative 1 would continue to be used to develop mitigation.

Some special status areas are expected to be designated because of the presence of American Indian traditional cultural values, practices, and resources. This designation would require exploration operations to file Plans of Operations, providing for increased consultation and mitigation development.

Roads and Structures. The proposed regulations would require that:

- Access roads minimize surface disturbance.
- Existing access be used where practical.
- Safe design be maintained.
- Natural contours be followed.
- Cuts and fills be minimized.

All structures would be built and maintained according to state and local codes. Structures for use or occupancy are addressed in separate rules at 43 CFR 3715.

Handling of Potentially Acid-Forming, Toxic, or Other Deleterious Materials. The proposed regulations would incorporate guidance from BLM's acid rock drainage policy and current practices used by most field offices.

The proposed regulations require the use of static or kinetic testing of material to be mined to determine and guide the handling and placement of potentially acid-forming materials. The proposed regulations also require that management of this material be fully integrated with operational procedures, facility design, and environmental monitoring programs throughout the project life.

The proposed regulations establish a hierarchy for control and mitigation of potential impacts of the mining of these materials. Acid rock drainage (ARD) control would focus on prevention or control of the oxidation of acid-forming minerals. If the formation of ARD cannot be prevented, potential migration of ARD must be prevented or controlled. Capture and treatment of ARD, or other undesirable effluent, to the applicable standard are required if source and migration controls do not prove effective. Long-term effluent capture and treatment would not replace the need for source control and could be relied upon only after source control methods have been employed.

Leaching and Processing Operations and Impoundments. The proposed regulations incorporate current practices in use by most field offices and the requirements from BLM's cyanide management policy. These requirements would apply to mines that use cyanide or other leaching agents.

The proposed regulations would require cyanide facilities to be able to contain, at the least, the greatest operating water inventory in addition to the 100-year, 24-hour storm event, including snowmelt events and expected draindown from heaps during power outages. This is a slight change from the existing cyanide management policy, which states that facilities must either contain the 100-year, 24-hour storm, or meet minimum state requirements.

The proposed regulations would require the building of secondary containment systems around vats, tanks, or recovery circuits adequate to prevent the release of toxic solutions in a primary containment failure.

The proposed regulations would require monitoring to detect any leakage from heaps, tailing impoundments, and other solution containment structures. As part of reclamation, upon release to the environment or during temporary closure, cyanide solutions and heaps would have to be neutralized or detoxified to the levels specified in the approved Plan of Operations.

The proposed regulations would require operators to take measures to prevent wildlife mortalities. All areas with exposed cyanide solution, including heaps, would be fenced and covered to prevent access by the public, wildlife, and livestock. Detoxification of exposed solutions might be used in lieu of fencing tailings impoundments.

Stability, Grading, and Erosion Control. The proposed regulations would specify that erosion must be minimized during all phases of operations. All disturbed areas would have to be graded or otherwise engineered to a stable condition to minimize erosion and facilitate revegetation. All areas would be recontoured to blend in with the premining natural topography to the extent feasible.

Waste Rock, Tailings, and Leach Pads. The proposed regulations require that these facilities be located, designed, built, operated, and reclaimed to minimize contamination of surface and ground water, achieve stability, and to the extent economically and technically feasible, blend with the premining topography. These general requirements would be applied to the individual project to develop specific operating plans.

Pit Backfilling and Reclamation. The proposed regulations would defer determining the amount of backfilling required to a site-specific analysis prepared during review of the Plan of Operations. BLM would use information from the operator to consider economic, environmental, and safety factors in establishing the amount of backfilling, if any, required. Mitigation would be required for pit areas that are not backfilled.

The economic feasibility determination expected under the proposed pit backfilling requirement would not be a detailed review of the project economics, such as rate of return on investment. BLM does not intend to determine what is a reasonable profit margin for mine operators. That an operator could completely backfill a pit and still show a profit does not automatically mean BLM would require backfilling. Nor would an operation that appears to be uneconomic, even without any backfilling, be exempt from backfilling. When considering the economic feasibility of pit backfilling, BLM would weigh the expected environmental benefits in relation to such operational economic factors as the following:

- Whether the project is a single or multiple pit operation.
- Distance and grade from mine site to waste rock storage versus backfill location.
- Direct haul cost versus temporary storage and rehandling cost.
- Reclamation costs as a function of the size of the disturbance area.

The proposed regulations require mitigation for pit areas that are not backfilled. The type of mitigation expected is not a dollar-for-dollar cost compensation (i.e. for every $1 of backfill cost saved $1 must be spent on mitigation) or necessarily an acre-for-acre compensation (i.e. for every acre of unreclaimed pit an acre must be provided as mitigation). Instead, the intent of the mitigation requirement is to ensure that the impacts of not backfilling pit areas are mitigated.

For example, if leaving a pit highwall creates a safety hazard, required mitigation might include erecting perimeter fencing and posting hazard signs. If the pit area is in critical wildlife habitat that cannot be restored unless backfilled, then the mitigation might require providing replacement habitat at another location.

The existing regulations allow areas to remain unreclaimed to preserve evidence of mineralization. The proposed regulations would also allow disturbed areas to remain unreclaimed for the same reason, but only temporarily. Operators would eventually have to reclaim all areas for which they are responsible. Any areas left temporarily open to establish mineralization must be described in the reclamation plan along with a time frame for completing final reclamation.

Financial Guarantees (Bonding)

The proposed regulations would require reclamation bonding for all Notice- and Plan-level operations. This is a major change from the existing regulations, which do not require Notice- level operations to give financial assurance. The financial guarantee (reclamation bond) would have to cover 100% of the estimated cost for BLM to perform the reclamation according to the reclamation plan. Corporate guarantees would no longer be acceptable as financial assurance for reclamation performance.

The proposed regulations would allow equivalent bonding by state agencies but only if the bonding instrument is also redeemable by the Secretary of the Interior. State bond pools would also be allowed if the BLM state director determines that the state bond pool gives a level of protection equivalent to BLM requirements. BLM would notify the public and allow it to comment before final bond release. The proposed regulations would also specify setting up trust funds or other funding mechanisms for post-reclamation treatment or maintenance.

Inspection and Monitoring

Operators would have to allow BLM to inspect operations to determine compliance with the proposed regulations. The current policy is to inspect operations four times annually where cyanide is used or a significant potential exists for acid rock drainage. This policy would be adopted into the proposed regulations. The proposed regulations would also allow citizens under certain circumstances to annually tour mining operations upon prior request. BLM will be responsible for arranging the tour with the operator.

Environmental monitoring programs would continue to be developed during the review of Plans of Operations. The operator would conduct environmental testing (water, air, soil, etc.) according to an approved monitoring plan. BLM could take samples during inspections to verify the monitoring program results.

Penalties for Noncompliance

The proposed regulations would allow BLM to issue enforcement orders for failure to comply with the Notice or Plan or the regulations. Two types of enforcement orders could be issued: the noncompliance order and the suspension order. BLM would issue temporary immediate suspensions to operators who fail to comply with a noncompliance order if needed to protect health, safety, or the environment from imminent danger or harm. The orders would specify the following:

- How the operation is not complying with the regulations.
- The portion of operations that must cease or be suspended.
- The actions that must be taken to correct the noncompliance.
- The time by which corrective actions must be taken and completed.

BLM could revoke a Plan or nullify a Notice upon finding that the operator has failed to correct violations within the specified time.

The proposed regulations would give BLM the discretion to issue civil penalties of up to $5,000/day for violation of the regulations or failure for comply with an enforcement order. The operator could request a hearing with the Department of the Interior, Office of Hearings and Appeals on the amount of the civil penalty or enter into settlement discussions with BLM.

Appeals Process

The proposed regulations would provide the same appeals process for both the operator and third parties. All parties could appeal to the BLM state director and thereafter to the Interior Board of Land Appeals (IBLA) on any decision by which they are adversely affected. The state directors could decline to review the decision, in which case the next level of appeal would be to IBLA. All decisions would remain in *full force and effect* while under appeal unless a written request for a stay is granted by the reviewing entity.

Alternative 4: Maximum Protection

Under Alternative 4 the 3809 regulations would contain prescriptive design requirements for resource protection. These requirements would increase the level of environmental protection and give BLM more discretion in determining the acceptability of proposed operations. Provisions of Alternative 4 are summarized in Table 2-1. Major changes from the current regulations include the following:

- Expanded application to public lands with any mineral or surface interest.
- Numerical performance standards for mineral operations.
- Required pit backfilling.
- Elimination of Notices so that all disturbances greater than casual use require Plans of Operations.
- Required conformance with land use plans.
- Prohibitions against causing irreparable harm or having to permanently treat water.

Unnecessary or Undue Degradation Definition

Alternative 4 would change the definition of unnecessary or undue degradation to require a greater level of resource protection and impose a design-oriented regulatory program. *Unnecessary or undue degradation* would be defined to mean that operations could not irreparably harm resources and that the operator would have to use best available technology and practices as environmental controls.

Project Area Definition

The project area would include the same activities as under the existing regulations. The area's boundary would have to be defined either by legal description or a metes and bounds survey and approved by BLM. Lands could lie within only one project area at a time to prevent confusion over operators and their reclamation liabilities.

Public Lands Definition

The definition of public lands on which the regulations apply would be expanded to include all lands whose mineral estate is federal and surface is private or state owned. The definition would also include lands where BLM manages the surface but the mineral estate is private or state owned. Surface owner consent would be required before BLM would approve operations on non-BLM managed surface.

Disturbance Categories and Thresholds

Casual Use. For all activity other than claim staking and surface sampling the operator would have to consult with BLM to determine if the activity is casual use or if a Plan of Operations is required. Some activities now regarded as casual use, such as hand digging, geochemical or geophysical exploration, and small-scale suction dredging, would require an approved Plan of Operations before the surface could be disturbed.

Notices. The regulations under Alternative 4 would not contain a Notice provision. All types of activity now conducted under a Notice would require an approved Plan of Operations before the land could be disturbed.

Plans of Operations. All disturbance greater than casual use would require a Plan of Operations. A Plan of Operations might be required for activity as slight as obtaining small surface samples with hand tools. But the content and processing requirements for Plans would vary greatly, depending on the size of the proposed activity.

Claim Validity and Valid Existing Rights

All Plans of Operations proposing mining would require an economic feasibility study. This requirement would apply to all lands that are subject to mining claims with valid existing rights, not just those that have been segregated or withdrawn. To justify the potential environmental impacts, the feasibility study would be used to determine whether the proposed operation is feasible both technically and economically. BLM would not approve any Plans of Operations that are not economically feasible. Plans of Operations proposing exploration would not have to be supported by an economical feasibility determination because the purpose of exploration is to obtain data for evaluating feasibility.

Common Variety Minerals

Mining of material thought potentially to be of common variety, and therefore not locatable under the Mining Law, would not be allowed under the 3809 regulations. Common variety determinations would have to be made and the material would have to be classified as a locatable mineral before BLM would approve Plans of Operations. The regulations would not provide for the use of an escrow account pending the outcome of the common variety determination as is currently the practice.

State-Federal Coordination

The regulations would not allow states to play the lead role for any element of the surface management program on BLM lands. Rather, the regulations would provide for BLM to coordinate and work cooperatively with the states so that operations meet the requirements of both state and federal regulations. Conditions would be placed on operations so that the most protective environmental requirement would apply. Should an operation be unable to comply with both BLM and state regulations, it would have to meet BLM requirements.

Existing Operations

Under Alternative 4 all existing Notices would expire in 2 years. The disturbance would have to be reclaimed within 2 more years, or the Notice would have to be replaced by a Plan of Operations. Any existing or pending Plans of Operations would be required to comply with the new regulations in the following manner:

1. Within 180 days the operator would have to file a modified Plan of Operations describing how the requirements of the new regulations would be met.
2. BLM would determine the adequacy of the modification in meeting the new requirements and might grant exceptions from requirements for economic, environmental, safety, or technical reasons.
3. Any new facilities added to an existing Plans of Operations would have to comply with the regulations unless the operator can show that compliance is not feasible for environmental, safety, or technical reasons.
4. Modifications made to existing mine facilities would have to comply with the regulations unless compliance is shown not to be feasible for environmental, safety, or technical reasons (no economic exemptions).

Plan of Operations Content and Processing

Because Alternative 4 would not have a Notice provision, all activity greater than casual use would require a Plan of Operations. The content and processing of the Plan would generally be the same as that described for Alternative 3. But certain performance standards, such as the requirements to prevent irreparable harm, prohibit permanent water treatment, and complete mine pit backfilling, would make Plan approval less certain.

Modifications

The same modification process would be followed as described for Alternative 3. BLM may require the operator to modify the Plan of Operations to prevent unnecessary or undue degradation. Plan modifications would be required at final closure to address unanticipated conditions or new information. All Plans must be renewed every 5 years.

Temporary or Permanent Closure

Temporary or permanent closure would be the same as under Alternative 3. Operators would have to file and follow interim management plans. Plans that are not renewed, or are determined to be abandoned, might be terminated and final reclamation directed.

Performance Standards

General. The regulations would specify the minimum national design standards for exploration, mining, and reclamation and mandate that activities not cause irreparable harm. Irreparable harm would mean to permanently impair the productivity of the land.

Land Use Plans. The regulations would require that all operations be conducted according to the approved BLM land use plans in areas open to mineral activity under the Mining Law. But land use plans could not be used in place of segregations and withdrawals. Land use plans would be used to help determine sensitive areas and to define what would constitute irreparable harm to these resources.

Surface and Ground Water Protection. The water quality in mine pit lakes could not exceed the acute toxicity standard for metals so as not to endanger wildlife, public water supplies, or users. The regulations would require that operators not rely on water treatment to meet the water quality standards for more than 20 years after closure. The operator would be required to show that, after closure, the operation could comply with the water quality standards through source controls after 20 years. BLM would not approve Plans of Operations that could not demonstrate compliance with this standard.

The regulations would require the operator to restore the hydrologic balance of surface and ground water upon reclamation. Water could be pumped or transported to restore the hydrological balance but not for longer than 20 years after mine closure. BLM would not approve Plans that could not demonstrate compliance with this standard.

The regulations would specify minimum design standards for drilling and plugging exploration drill holes. All drill cuttings and mud would have to be contained onsite using sumps or portable tanks. All exploration drill holes would have to be plugged from bottom to no more than 10 feet of the surface with bentonite or a similar compound to prevent mixing of waters from aquifers, impacts to beneficial uses, downward water loss, or upward water loss from artesian conditions. The upper 10 feet would have to be plugged with cement.

Wetlands and Riparian Area Protection. Specific site selection and mitigation criteria would require operators to do the following:

- Avoid locating operations in wetland and riparian areas where possible.
- Minimize impacts to wetlands and riparian areas.
- Mitigate damage to wetland and riparian areas by restoring them to proper functioning condition within 10 years after operations close or by using offsite replacement at a ratio of at least 1.5 acres for every acre disturbed.

Soil or Growth Media Handling. Soil or other growth media would be removed from the lands disturbed by operations, segregated by soil horizon, and preserved for later use in revegetation during reclamation.

Revegetation Requirements. All disturbed lands would have to be revegetated according to the schedule in the reclamation plan to establish a stable, long-lasting, and self-sustaining vegetation cover. Canopy cover would have to consist of at least 90% of adjacent undisturbed lands with similar elevation, slope, and aspect at the same time of year. Only native species could be used. Operations, including revegetation, would have to prevent the introducing of noxious weeds or eliminate any existing infestations.

Fish and Wildlife Protection and Habitat Restoration. Within 10 years of closure the operator would have to minimize disturbance and restore any disturbed habitat to proper functioning premining condition.

Special status species would be protected the same as threatened and endangered species. Mineral operations could not affect special status species, causing them to be listed as threatened or endangered.

Protecting Cultural Resources. The regulations would not limit the time for data recovery of significant cultural resources and would require that the operator bear the cost of recovery.

Protecting Paleontological Resources. The regulations would not limit the time for data recovery of significant paleontological resources and would require that the operator bear the cost of recovery.

Protecting Cave Resources. The regulations would not limit the time for data recovery of significant cave resources and would require that the operator bear the cost of recovery.

Protecting American Indian Traditional Cultural Values, Practices, and Resources. Special status areas, designated through land use planning as containing American Indian traditional cultural resources, would require concurrence by affected American Indians before BLM would approve a Plan of Operations.

Roads and Structures. Roads built for access, haulage, service, or exploration could not have maximum sustained grades greater than 10%. Short pitches of less than 300 feet might be used to take advantage of topography, but the grade could not exceed 12%. Diagonal drainage barriers would be placed as follows:

Grade %	Max. Spacing (ft)
0 - 2	200
3 - 8	15
9 -12	80

All roads would be reclaimed to approximate original contours. All structures would be built and operated according to codes and removed at the end of operations

Handling of Potentially Acid-Forming, Toxic, or Other Deleterious Materials. Alternative 4 would have the same provisions as Alternative 3 with more design specifics and unsuitability criteria. BLM could set criteria to determine if certain deposits are unsuitable for mining because of their acid-forming and acid-neutralizing mineral content, climate, and control technologies. Materials exceeding these criteria could not be mined. Potentially toxic mine wastes (e.g. pond sludge and lab wastes) could not be disposed of on BLM-managed lands. And plans proposing treatment periods longer than 20 years to meet standards would not be acceptable and would be denied.

Leaching and Processing Operations and Impoundments. The Alternative 4 regulations would contain the same elements as described for Alternative 3, but with more design specifics. Processing facilities that use cyanide would have to be able to contain, at the least, the greatest operating water balance in addition to the probable maximum precipitation event, including snowmelt events and expected draindown from heaps during power outages. Secondary containment systems would have to be built around vats, tanks, or recovery circuits adequate to contain 110% of the maximum contents in the event of primary containment failure.

All leach pad liner systems would have to employ at least two synthetic liners, with a drain layer to reduce the hydrostatic head, over at least 24 inches of compacted clay. Each synthetic liner would have to be at least 40 mils thick. The clay liner would have to be compacted to a permeability of less than 1x10-7 cm/sec. Leak detection and recovery systems would be required for heaps and other solution containment structures.

The ore heap and leach pad would have to be stable throughout construction and operation. A minimum factor of safety of 1.3 would be required under operating conditions.

Heaps, tailings, or other cyanidated material would have to be detoxified at closure (or during periods of prolonged inactivity) to effluent levels of less than 0.2 mg/l weak acid dissociable cyanide, pH between 6.0 and 8.5, and metal levels less than the maximum contaminant level. Postclosure discharges would have to achieve levels acceptable to the state and the U.S. Environmental Protection Agency.

Stability, Grading, and Erosion Control. Erosion would have to be controlled so that soil loss would not exceed 2 tons/acre/year. All excavations (roadcuts, drillsites, etc.) would have to be recontoured approximately to the original contour. Recontoured waste rock and spent ore would be graded to no steeper than 3h:1v.

Pit Backfilling and Reclamation. The regulations would exempt operations from backfilling only where backfilling is determined to be environmentally unsound or unsafe.

Financial Guarantees (Bonding)

Reclamation bonding requirements would be the same as described for Alternative 3. In addition, bond coverage would be expanded to include unplanned events such as spills or facility failures.

Inspection and Monitoring

BLM would be required to inspect all operations at least four times a year. Operators would be required to hire independent third parties to conduct environmental monitoring. BLM would be required to take samples during inspections to verify the results of the monitoring program.

Penalties for Noncompliance

The penalty system for noncompliance would be the same as under Alternative 3 except enforcement orders and penalties would be mandatory and have to be issued for any observed noncompliance. Operators with unresolved noncompliances could have future permits blocked until the noncompliance is resolved.

Appeals Process

The appeals process would be the same as described for Alternative 3 except that all decisions would be *automatically stayed from effect* during consideration of the appeal unless a written request for implementation is granted by the relevant reviewing official (either the BLM state director or the Interior Board of Land Appeals).

Alternative 5: NRC Recommendations

Alternative 5 would change the existing regulations only where specifically recommended by the NRC report. BLM would not use other aspects of the NRC (1999) report to develop changes to the 3809 regulations as was done under Alternative 3.

Unnecessary or Undue Degradation Definition

Under Alternative 5 the definition of *unnecessary or undue degradation* would remain same as Alternative 1. The prudent operator standard would be retained, and operators would have to follow "usual, customary, and proficient" measures, mitigate impacts, comply with all environmental laws, perform reclamation, and not create a nuisance.

Project Area Definition

The definition of *project area* would also remain the same as under Alternative 1: a tract of land upon which operations are conducted. The project area would include the area required for building or maintenance of roads, transmission lines, pipelines, or other means of access. The project area could include one or more mining claims, but the claims would have to be under one ownership.

Federal Lands Definition

The definition of *federal lands* would remain the same as under Alternative 1. The lands where the regulations would apply would stay the same: BLM-administered lands subject to the Mining Law.

Disturbance Categories and Thresholds

Under Alternative 5 disturbance categories and thresholds would be the same as under Alternative 3, but Alternative 5 would probably not expand the types of special status lands were a Plan of Operations was always required for any surface disturbance exceeding casual use. The Notice-Plan threshold would be based on the division between exploration and mining. All mining, milling, and bulk sampling involving more than 1,000 tons, would require a Plan of Operations.

Exploration disturbing less than 5 acres could still be conducted under a Notice unless occurring on special status lands. Exploration on special status lands, or disturbing more than 5 acres would require a Plan of Operations. Special status areas would include areas of critical environmental concern (ACECs), the California Desert Conservation Area, wild and scenic rivers, wilderness areas, areas closed to off-road vehicles, and other formally designated areas.

Claim Validity and Valid Existing Rights

As under Alternative 1, BLM would have the option of determining valid existing rights before approving Plans for operations in segregated or withdrawn areas.

Common Variety Minerals

As under Alternative 1, BLM under Alternative 5 would not change the way it handles common variety minerals. BLM policy provides for holding escrow during operations if materials to be mined may be of a common variety and subject to payment of fair market value.

State-Federal Coordination

State-federal coordination under Alternative 5 would remain the same as at present (Alternative 1.) Agreements in each state would provide for coordination for review, approval, bonding, monitoring, and enforcement action. States might have the lead for some program elements, but the most restrictive requirements (BLM or state) would apply. Agreements or memorandums of understanding (MOUs) would be developed or modified to give clear procedures for BLM to refer certain noncompliance actions to other federal and state agencies for enforcement.

Existing Operations

Existing operations under Alternative 5 would be the same as under Alternative 3 but would not include new performance standards. Existing Notices would expire after 2 years unless bonded and extended. Existing Notices for mining would not be required to refile as Plans of Operations if disturbance area does not increase.

Existing Plans, pending Plans or Plan modifications would be subject to the new regulations and would have to meet the new bonding requirements within 180 days of the new regulations becoming effective.

Modifications made to existing mine facilities after the effective date would have to comply with the new regulations unless shown not practical for economic, environmental, safety, or technical reasons.

Notice and Plan of Operations Content and Processing

As under Alternative 1, BLM would continue to be required to review Notices within 15 calendar days, and initially review Plans in 30 days with an option for 60 more days of review time. Time frames would be open-ended for Plans for EIS, National Historic Preservation Act, and threatened and endangered species compliance.

Public comment periods would be allowed for environmental assessments if BLM determines that there is substantial public interest.

Operators would provide Plan of Operations interim management plans for periods of temporary closure.

Modifications

As under Alternative 3, Alternative 5 would eliminate the requirement for BLM to demonstrate unforeseen issues that warrant modification and would allow BLM to require operators to modify Notices or Plans to prevent unnecessary or undue degradation. BLM could also require plan modifications at final closure to address unexpected conditions or new information.

Temporary or Permanent Closure

As under Alternative 3, operators would have to follow required interim management plans during periods of temporary closure for Plan-level operations. BLM might consider these operations abandoned, depending on length of inactivity and condition of equipment. After 5 consecutive years of inactivity, BLM might terminate the Plan of Operations and direct final reclamation.

Notices would expire after 2 years. BLM might consider the Notice-level operation abandoned and order final reclamation, depending on time and condition of site and equipment.

Once it determines that a Notice- or Plan-level operation is abandoned, BLM would begin forfeiture on the financial assurance and perform the required reclamation if the operator cannot or will not do so.

Performance Standards

General. As under Alternative 1, operators would be required to prevent unnecessary or undue degradation and follow requirements at 3809.1-3(d). Other site-specific performance requirements might be developed during individual project review.

Land Use Plans. As under Alternative 1, land use plans would continue to be used to give resource information and determine resources of special management concern when processing Notices or approving Plans of Operations.

Surface and Ground Water Protection. As under Alternative 1, all operators would have to comply with federal and state water quality standards. Project approvals would establish acceptable postclosure water quality conditions for pit lakes suitable for long-term use of the site and conditions needed to adequately protect ground and surface waters, wildlife, and waterfowl.

Wetlands and Riparian Area Protection. As under Alternative 1, state and 404 permits from the Army Corps of Engineers would have to be acquired for dredging or filling in U.S. waters. BLM would continue to emphasize riparian area management during project review without a specific performance standard.

Soil or Growth Media Handling. As under Alternative 1, where reasonably practicable, topsoil would have to be saved and reapplied to disturbed area after reshaping has been completed.

Revegetation Requirements. As under Alternative 1, Alternative 5 would require that disturbed areas be revegetated where reasonable and practicable and that revegetation provide a diverse vegetation cover. Revegetation would be a part of the requirement to rehabilitate wildlife habitat. The prohibition against the creation of a nuisance would be used to address noxious weed control.

Fish and Wildlife Protection and Habitat Restoration. Same as Alternative 1. The operator must take needed action to prevent harm to threatened and endangered species and their habitat that might be affected by operations. Reclamation must include rehabilitating fisheries and wildlife habitat.

Protecting Cultural Resources. As under Alternative 1, Alternative 5 would use the National Historic Preservation Act Section 106 process to develop mitigation for cultural resources found before Plan approval.

Operators could not knowingly disturb, alter, injure, or destroy any historical or archaeological site, structure, building, object, or cultural site discovered during operations. Operators must immediately notify BLM of any cultural resources found during operations and must leave such discoveries intact. BLM has 10 working days to protect or remove the discovery at the government's cost, after which operations may proceed.

Protecting Paleontological Resources. As under Alternative 1, operators under Alternative 5 could not knowingly disturb, alter, injure, or destroy any scientifically important paleontological remains.

Operators must immediately notify BLM of any paleontological resources discovered during operations and must leave such discoveries intact. BLM has 10 working days to protect or remove the discoveries at the government's cost, after which operations may proceed.

Protecting Cave Resources. Like Alternative 1, Alternative 5 does not address the protection of cave resources. Such resources would be addressed on an individual basis when they are identified during project review.

Protecting American Indian Traditional Cultural Values, Practices, and Resources. Like Alternative 1, Alternative 5 does not specify the protection of these resources except when part of cultural resources under the National Historic Preservation Act. Consultation with American Indians would be used to develop mitigation on a case-by-case basis.

Roads and Structures. As under Alternative 1, operators in building roads and structures under Alternative 5 would be required to do the following:

- Minimize surface disturbance.
- Use existing access where practical.
- Maintain safe design.
- Follow natural contours.
- Minimize cuts and fills.

Operators would have to consult with BLM for roadcuts greater than 3 feet on the inside edge.

All structures would have to be built and maintained according to state and local codes. Structures are addressed in separate rules at 43 CFR 3715.

Handling of Potentially Acid-Forming Toxic or Other Deleterious Materials. As under Alternative 1, Alternative 5 would require that reclamation include measures to isolate, remove, or control toxic or deleterious materials. Other requirements imposed would be based on site- specific review according to the BLM acid rock drainage policy or other policies and handbooks

Leaching and Processing Operations and Impoundments. As under Alternative 1, Reclamation under Alternative 5 would have to include measures to isolate, remove, or control toxic or deleterious materials. Other requirements imposed would be based on site-specific review according to BLM policies (cyanide management policy, BLM state cyanide management plans, and acid rock drainage policy).

Stability, Grading, and Erosion Control. As under Alternative 1, reclamation would have to include measures to control erosion, landslides, and runoff.

Pit Backfilling and Reclamation. As under Alternative 1, the amount of pit backfilling under Alternative 5 would be determined on a case-by-case basis. Stable highwalls might remain where needed to preserve evidence of mineralization.

Financial Guarantees (Bonding)

As under Alternative 3, the regulations under Alternative 5 would require reclamation bonding for all Notice- and Plan-level operations. This is a major change from the existing regulations, which do not require Notice-level operations to give financial assurance. The reclamation bond would have to cover 100% of the estimated cost for BLM to perform the reclamation according to the reclamation plan. Corporate guarantees would no longer be acceptable as financial assurance for reclamation performance.

Alternative 5 would also allow equivalent bonding by state agencies but only if the bonding instrument is redeemable by the Secretary of the Interior. State bond pools would be allowed if the BLM state director determines that the state bond pool gives a level of protection equivalent to BLM requirements. BLM would notify the public and allow it to comment before final bond release. The proposed regulations would also specify setting up trust funds or other funding mechanisms for post-reclamation treatment or maintenance.

Inspection and Monitoring

As under Alternative 1, operators under Alternative 5 would have to allow BLM to inspect their operations. Existing policy calls for inspections four times annually where cyanide is used or a significant potential exists for acid rock drainage, and twice annually for all other operations.

Monitoring programs would be developed during Plan review, and operators would conduct environmental testing (water, air, soil, etc.) and submit the results to BLM. BLM might take check samples during inspections.

Penalties for Noncompliance

As under Alternative 3, BLM under Alternative 5 would issue discretionary administrative penalties ($5,000/day), suspensions, revocation of Plan approval, and nullification of Notices for failure to comply with enforcement orders. BLM would refer certain noncompliance actions to other federal and state agencies for enforcement. Alternative 5 would have no additional provisions on criminal penalties. BLM would continue to use the current criminal penalties process.

Appeals Process

As under Alternative 1, BLM decisions under Alternative 5 would have to be appealed within 30 days. Operators would have to appeal to the BLM state director and then to the Interior Board of Land Appeals (IBLA). Third parties would appeal BLM decisions directly to IBLA. BLM's decisions would be in full force and effect during appeals unless IBLA grants a written request for a stay.

Implementation Costs

The adequacy of BLM's funding and staffing was a concern voiced by many comments during scoping and on the draft EIS. Since we are required to analyze the environmental consequences of each alternative assuming full implementation, we have estimated the current surface management workload and expenditures, and expected funding requirements for the alternatives, including the No Action and Proposed Action alternatives.

Current Workload and Fiscal Resources

The BLM Management Information System tracks expenditures and accomplishments for most of BLM's major program areas, including its surface management responsibilities under the 3809 regulations. The accounting/budget system accounts for processing Notices and Plans of Operations, preparing National Environmental Policy Act documents, responding to appeals, inspecting mineral operations, and carrying out enforcement actions. For fiscal year 2000, we estimate that BLM will process 665 Notices and Plans of Operations at a cost of $15.5 million. By the end of the fiscal year we will make about 3,000 inspections, costing $3.1 million. In addition, some surface management responsibilities are carried out as part of our general land and resource management. But processing Notices and Plans and conducting inspections accounts for most of our surface management responsibilities and expenditures.

In general, the level of funding and staffing will not directly affect the number of Notices and Plans processed but may affect the timeliness of those reviews and approvals. The number of Notices and Plans ultimately processed is driven by the number that operators submit to BLM. By regulation, operators must notify BLM at least 15 days before beginning operations under Notices.

Within that 15-day period, BLM does not approve Notices but reviews proposals to ensure that unnecessary or undue degradation would not occur. Except for Notices that lack the information needed for the review, we generally process Notices within the 15-day period.

BLM must review and approve Plans of Operations within 30 days after they are filed. The current regulations allow 60 days for further review and site inspection, or more time to complete National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA), or Endangered Species Act (ESA) requirements.

When an EIS is required or threatened and endangered species or cultural resources may be affected, the regulations do not specify a time frame for the approval process. For these more complex efforts, Plan of Operations approval takes at least a year and a half. Much of this protracted approval process is due to processing requirements, such as the NEPA, NHPA, ESA and Native American consultation. But current funding and staffing are also factors.

For simple projects that do not require EISs and are not expected to affect threatened and endangered species or cultural resources, BLM approves Plans of Operations within 2 to 6 months, depending on the office workload and the site specifics of the Plan. In these situations, delays beyond the time frame allowed by the regulations are mainly due to funding and staffing for processing Plans. Even though current funding and staffing for processing Notices and Plans may not be optimal, they are generally adequate.

The number of inspections conducted versus the number that are required by policy can be easily estimated and directly tied to funding and staffing allocated to that function. By policy, BLM is to carry out four inspections per year for operations that use leachate and at least one inspection per year for all other operations. On the basis of the existing policy on inspection frequency and data on currently active Notices and Plans of Operations, at least 7,000 inspections should be conducted this fiscal year versus the 3,000 inspections we expect to complete this fiscal year. We estimate that 7,000 inspections would cost $8.7 million, or about $4.0 million above the current expenditure level.

Alternative 1: Existing Regulations (No Action)

Overall activity levels in the form of new and amended Notices and Plans are expected to remain steady into the foreseeable future. For our analysis we assume that BLM will receive 600 Notice and 150 Plans per year for the foreseeable future. Under the No Action Alternative, full implementation would at a minimum require funding and staffing to meet all the processing and inspection needs discussed above. In addition, program funding and staffing needs to fully implement the existing regulations might increase in the future because of several factors:

- Inflation and cost of living adjustments.
- Increased regulatory attention given to technically complex or controversial projects.
- An increasing number of operations entering the closure phase and thereby requiring modifications to the Plans of Operations, new NEPA analysis, and intensive regulatory involvement.

One example of an emerging workload is bankruptcies. Nevada currently has 29 operations whose operators are in bankruptcy. These bankruptcies create a new complex workload in which BLM has little experience and the full impact on funding and staffing needs are still unknown. Overall we estimate that full implementation will require at least a 20% increase in the current expenditure level, or about $24.3 million.

Alternative 2: State Management

The cost for BLM to implement the regulatory program under Alternative 2 would be greatly reduced from the current and projected levels under the existing regulations (Alternative 1). BLM would still have the ongoing program costs, including commenting on proposed operations and monitoring state programs to ensure against unnecessary or undue degradation of the public lands. Once BLM discontinues program administration, costs would be minimal compared to the cost of the existing program. The program under Alternative 2 would cost BLM about 10% of the current program needs, or about $1 million annually. That cost estimate assumes that BLM does not give funding to the states.

Alternative 3: Proposed Regulations

The cost to the BLM state and field offices to implement the proposed regulations would increase in spite of an expected reduction in overall mineral activity under this alternative. The largest area of increased costs would consists of costs to process Notices and Plans, including the following:

- Screening proposed operations for substantial irreparable harm.
- More validity examinations for proposed operations on withdrawn and segregated lands.
- More common variety determinations where proposed operations may be extracting common variety minerals.
- Bonding for all Notices.
- Processing Plans for all mining activity.
- Mandatory public comment periods for all Plans.
- Increased processing requirements for suction dredging.
- More appeals.

Under Alternative 3 we estimate that each year BLM will process from 300 to 340 Notices and 290 to 330 Plans. Processing costs would be about $20.0 million, which is about $4.5 million above the current funding for processing Notices and Plans. Large unknowns in this estimate are the following:

- The added cost of dealing with the review and consultation requirements for the substantial irreparable harm provision.
- The increase in the number and complexity of appeals received.
- The cumulative effect on the workload as a result of the many procedural changes under this alternative.

The drop in mineral activity expected under Alternative 3, which would range from 5% to 30% depending on the size and type of operation, would reduce the current inspection shortfall of $4.0 million by about $0.7 million. Total inspection costs would be about $7.0 million. We estimate to fully implement the program under the Proposed Action, including the new processing costs and the inspection needs discussed above, would require a 35% increase in the current expenditure level, or about $27.0 million.

Alternative 4: Maximum Protection

Alternative 4 would significantly reduce mineral activity, by from 10% to 75% depending on the size and type of activity. But, Alternative 4 would require operators for all activity greater than casual use to prepare Plans of Operations. BLM estimates that the annual surface management workload would include processing 480 to 580 Plans of Operations. Part of the process would include evaluating the proposed technology to ensure the use of the best available technology and compliance with specific design standards in each Plan, and the preparing of a validity examination for every project.

BLM expects that Plan processing costs will be $25.9 million per year. Because of the drop in the number of operations, we expect field inspection costs to drop. But with mandatory enforcement we expect total inspection and enforcement costs to be in line with our estimate for the No Action Alternative ($8.7 million). Overall, the funding for fully implementing the Maximum Protection Alternative would require about $31.5 million.

Alternative 5: NRC Recommendations

Because of the requirements to bond Notices and to file Plans of Operations for all mining, processing costs would increase under the NRC Recommendations Alternative. BLM estimates that BLM will need to process 360 to 380 Notices and 340 to 360 Plans per year at a cost of $19.5 million, an increase of $4.0 million over current expenditures. In addition, inspection costs would decline from the current level. BLM estimates that the shortfall from the current expenditures would be $3.1 million. Total processing and inspection costs would be about $27.3 million.

Alternatives Considered But Eliminated from Detailed Analysis

The alternatives considered in detail represent a reasonable range of alternatives to address the issues recognized by scoping. All of the major technical and regulatory issues are considered in at least one of the alternatives that are analyzed in detail. Other issues, such as Mining Law reform, cannot be resolved through rulemaking and were not used in developing alternatives.

Other alternatives considered but eliminated from detailed analysis include one that would consider funding levels or mandating complete funding of the existing regulations and one requiring complete restoration to premining conditions.

The complete funding alternative was eliminated as redundant. The EIS analysis needs to assume the complete implementation of alternatives to fully consider the potential environmental impacts of an alternative's being selected. The analysis of the existing regulations (Alternative 1) is based upon complete implementation of that alternative, which implies complete funding. Complete implementation is also assumed for Alternatives 2, 3, and 4 when assessing potential impacts. The EIS does estimate the relative cost to implement each alternative. Although regulatory programs are often underfunded, assuming complete implementation when presenting the impacts allows the public and the decision maker to see the relative cost versus benefits that might be achieved under the regulatory scheme of each alternative.

In developing a preferred alternative for consideration in the final EIS, two approaches may be taken if adequate funding appears not to be likely. The alternative may be modified to reduce implementing costs, or it may remain unchanged with the recognition that complete implementation would require adequate funding.

The alternative of requiring total restoration of disturbed lands to premining conditions was considered but eliminated from detailed analysis. Complete restoration would require restoring the premining topography with the same habitat composition and productivity levels. In contrast, reclamation requires attaining a stable and productive land area though not necessarily replacing the same predisturbance habitat or exact topography. Both the technical and economic difficulties of attaining complete restoration would make most mining operations on public lands infeasible. Complete restoration would conflict with BLM's multiple use mandate and would offer little commensurate environmental benefit over alternatives with aggressive reclamation requirements.

The alternative of adopting ISO 14000 standards was also considered but eliminated from detailed analysis. Established by the International Organization for Standardization, ISO 14000 standards provide a framework a company can use to incorporate a voluntary environmental management system (EMS) into its operations. Integrating an EMS into a company's operations can offer guidelines and opportunities for continuous improvement of the company's compliance and performance with environmental regulations. But ISO 14000 standards do not replace environmental regulations, and compliance is still necessary within a company's EMS framework. Consequently, ISO 14000 standards could be voluntarily adopted by a company within any of the alternatives analyzed in detail in this EIS and do not need to be considered separately.

National Research Council Report Consistency

The National Research Council evaluated the adequacy of the existing 3809 regulatory framework. The NRC report *Hardrock Mining on Federal Lands* (NRC 1999) contains both regulatory and nonregulatory recommendations for changes in the existing program. The NRC's Committee on Hardrock Mining on Federal Lands released this final report on September 29, 1999. The report concluded that improvements to the implementation of the existing regulations present the greatest opportunity for improving environmental protection and the efficiency of the regulatory process. The NRC report then listed gaps in the existing regulations and recommended regulatory and nonregulatory changes to the program.

After the release of the report, Congress directed that BLM could finalize the proposed 3809 regulations provided they were not inconsistent with the recommendations in the NRC report. BLM considers this requirement as prohibiting the agency from selecting as final regulations an alternative that would contradict or oppose a NRC recommendation. As a result, the proposed regulations and preferred alternative have been changed in the final EIS so as not to be inconsistent with the NRC report. Where NRC was silent on a specific aspect of the existing regulations, BLM's proposed changes would not be inconsistent with any NRC recommendations.

Preferred Alternative

BLM's preferred alternative is Alternative 3, the Proposed Action. The preferred alternative has been changed in the final EIS in response to comments and to not be inconsistent with the recommendations in the NRC report. It is also possible that future Congressional action may limit BLM's ability to adopt the preferred alternative. The timing of the legislative process (among other reasons) may make it impractical for the BLM to restructure the EIS and change the preferred alternative. In such circumstances, while the preferred alternative in this document may not change, the BLM may adopt one of the other alternatives, in whole or in part, to comply with the legislative directive.

Summary Tables

The last portion of this chapter presents three sets of tables that summarize important components of the EIS. Table 2-1 summarizes and compares the five alternatives by regulatory issue. The table describes the alternatives for each of the regulation components and then in detail for the performance standards, with a breakdown for each environmental or operating component. The numeric notation in the left column shows where the specific language on this subject can be found in the proposed regulations under Alternative 3.

Table 2-2 compares the NRC report conclusions or recommendations with both the existing and the proposed final 3809 regulations. This table allows the reader to see how NRC conclusions or recommendations compare with both the existing regulations and the proposed final 3809 regulations. Excerpts in the right-hand column have been taken near verbatim from the NRC report. Where the right-hand column in the table is blank, the NRC report makes no corresponding mention of this aspect of the regulations.

Table 2-3 summarizes the potential environmental impacts for each alternative. A detailed description of impacts is presented in Chapter 3 for each resource component.

BLANK

PAGE

Table 2-1. 3809 Regulation Alternatives Summary by Provision					
Regulation Issue	**Alternative 1: Existing Regulations (No Action)**	**Alternative 2: State Management**	**Alternative 3: Proposed Regulations (Preferred Alternative)**	**Alternative 4: Maximum Protection**	**Alternative 5: NRC Recommendations**
Casual Use Definition/ Suction Dredging [3809.5]	Activities resulting only in negligible surface disturbance and not involving mechanized earthmoving equipment, explosives, or vehicle use in areas closed to off-road vehicles. Interior Board of Land Appeals (IBLA) has recently ruled that suction dredges are not casual use.	Not applicable.	Cumulative impacts could exceed casual use level. Regulations would specify that small suction dredges could be casual use. BLM would not require a Notice or Plan for suction dredging if a state permit is required and BLM has a MOU with the state on suction dredging.	For all activities other than claim staking operator must consult with BLM to determine if the activity is casual use or a Plan is required.	No Change, same as Alternative 1.
Definition of Project Area [3809.5]	A tract of land upon which operations are conducted. Includes area required for building or maintaining roads, powerlines, pipelines, or other means of access. Project area may include one or more mining claims, but claims must be under one ownership.	Would not apply to most operations. Exclusive-use access roads, powerlines, pipelines, etc. would require rights-of-way from BLM.	Change would not specify that mining claims involved in a project be under single ownership.	Same as Alternative 3, except project area would have to be described by metes and bounds or legal description. BLM must approve a specific project area boundary.	No Change, same as Alternative 1.
Definition of Public Lands (Lands where regulations would apply) [3809.5]	BLM-administered lands subject to the Mining Law. Does not include lands where only minerals or surface is federal, except that amendments to the Stock Raising Homestead Act require BLM involvement when surface owner does not consent to mineral development.	No change from current definition.	Expand definition to include lands where mineral estate is federal, subject to the Mining Law, and surface estate is private under Stock Raising Homestead Act. Lands with reserved minerals from a sale or exchange could be open to operation of the Mining Law through a land use plan.	Same as Alternative 3.	No Change, same as Alternative 1.

Table 2-1. 3809 Regulation Alternatives Summary by Provision

Regulation Issue	**Alternative 1: Existing Regulations (No Action)**	**Alternative 2: State Management**	**Alternative 3: Proposed Regulations (Preferred Alternative)**	**Alternative 4: Maximum Protection**	**Alternative 5: NRC Recommendations**
***Unnecessary or Undue Degradation* Definition (UUD) [3809.5]**	Prudent operator standard. Follow "usual, customary, and proficient" measures. Mitigate impacts. Comply with environmental laws. Perform reclamation. Do not create a nuisance.	Compliance with all state programs for regulating mining, and other federal environmental laws, would be considered adequate for prevention of unnecessary or undue degradation as required by FLPMA.	Replace prudent operator standard with requirement to comply with performance standards. All activity must be reasonably incident to prospecting, mining, or processing operations. Add to definition: conditions, practices, or activities that cause substantial irreparable harm to significant scientific, cultural, or environmental resources that cannot be effectively mitigated.	Same as Alternative 3. Unnecessary or undue degradation would be defined to mean that operations could not irreparably harm resources and that the operator would have to use best available technology and practices as environmental controls. Replace prudent operator standard with requirement to comply with the performance standards. All activity must be reasonably incident to prospecting, mining, or processing operations.	No Change, same as Alternative 1.

Table 2-1. 3809 Regulation Alternatives Summary by Provision

Regulation Issue	**Alternative 1: Existing Regulations (No Action)**	**Alternative 2: State Management**	**Alternative 3: Proposed Regulations (Preferred Alternative)**	**Alternative 4: Maximum Protection**	**Alternative 5: NRC Recommendations**
Notice vs. Plan of Operations Threshold [3809.11]	Surface disturbance less than 5 acres per calendar year requires a Notice. Plans required for more than 5 acres a year of disturbance or for any activity above casual use in special status areas such as ACECs, California Desert Conservation Area, wild and scenic rivers, wilderness areas, and areas closed to off-road vehicles.	Filing a Notice or Plan with BLM is not required. States would handle all permitting of mineral activities on BLM lands.	Change threshold on the basis of division between exploration and mining. All mining, milling, and bulk sampling over 1,000 tons would require Plans. Exploration disturbing less than 5 acres would require Notices. Exploration in special status lands or disturbing more than 5 acres would require Plans. Expand special status lands to include: national monuments/conservation areas, and lands containing proposed or listed T&E species or their critical habitat.	Eliminate Notice provision. All disturbances exceeding casual use would require Plans of Operations.	Same as Alternative 3. Use existing special status lands.
Mining Claim Validity, Existing Rights, and Mine Economics [3809.100]	Not addressed in 3809 regs. Validity exams are required before Plan approval in wilderness areas per 8560 regulations. BLM has option of determining valid existing rights before approving Plans in segregated or with-drawn areas.	No Change. BLM always has option of examining any mining claim at any time.	Add requirement that validity exams determine valid existing rights before approval of Plans in areas withdrawn from operation of mining laws. Discretion to perform validity exams for segregated lands.	Same as Alternative 3 but an economic feasibility study is required for all Plans on all lands. BLM would not approve economically infeasible Plans of Operations..	No Change. Same as Alternative 1.
Common Variety Minerals [3809.101]	Not addressed in 3809 regs. Policy provides for holding escrow during operations if materials to be mined may be of a common variety and subject to payment of fair market value.	No change.	Regulations would provide for holding escrow during operations if materials to be mined may be of a common variety and subject to payment of fair market value.	Plans not approved and mining not allowed until classification of material to be mined has been resolved through a common varieties determination.	No Change. Same as Alternative 1.

Table 2-1. 3809 Regulation Alternatives Summary by Provision

Regulation Issue	**Alternative 1: Existing Regulations (No Action)**	**Alternative 2: State Management**	**Alternative 3: Proposed Regulations (Preferred Alternative)**	**Alternative 4: Maximum Protection**	**Alternative 5: NRC Recommendations**
State and Federal Government Coordination [3809.201-204]	MOUs in each state provide for coordination for review, approval, bonding, monitoring, and enforcement. State may have lead for some program elements. Most restrictive requirements (BLM or state) apply.	States would regulate all activity on BLM lands. BLM would periodically evaluate state program to determine if it is preventing unnecessary or undue degradation. BLM would continue to decide which areas are open or closed to mining through the land use planning and withdrawal processes.	When requested, BLM *must* give states the lead where state program is at least as strict as BLM requirements. BLM must concur on Plan approvals. BLM retains inspection and enforcement option and NEPA, NHPA, Tribal Govt.-Govt. coordination and T&E species responsibilities.	BLM has lead role on BLM lands and would coordinate with the states so that the more stringent regulations (federal or state) would apply to the project.	Same as Alternative 1. MOUs would be developed or modified to provide clear procedures for BLM to refer certain noncompliance actions to other federal and state agencies for enforcement.

Table 2-1. 3809 Regulation Alternatives Summary by Provision

Regulation Issue	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Applying Regulation Changes to Existing Operations or Facilities [3809.300] [3809.400] [3809.433-434]	Not applicable.	Existing activity could continue according to state requirements.	Existing Notices would expire after 2 years unless bonded and extended. Existing Notices for mining are not required to refile as a Plan if disturbance area does not increase. Existing Plans, pending Plans, or Plan modifications need not comply with new performance standards if filed before effective date of new regulations. All Plans would have to meet new bonding requirements within 180 days of effective date of new regula-tions. New mine facilities added to existing Plans after effective date would have to meet new regulation requirements. Modifications to existing mine facilities after effective date would have to comply with new regulations unless shown not practical for economic, environmental, safety, or technical reasons.	Notices expire in 2 years and must be reclaimed or replaced by Plans. Existing and pending Plans must comply with new regulations as follows: (1) Within 180 days operator would have to file a modified plan. (2) BLM may grant exceptions from specific requirements for economic, environmental, safety, or technical reasons. All new or modified facilities added to existing Plans must comply with the new regulations.	Same as Alternative 3 but without new performance standards. Existing Plans, pending Plans, or Plan modifications would be subject to new regulations and would have to meet new bonding requirements within 180 days of effective date of new regulations. Modifications to existing mines after effective date would have to comply with new regulations unless shown not practical for economic, environmental, safety, or technical reasons.

Table 2-1. 3809 Regulation Alternatives Summary by Provision

Regulation Issue	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Notice and Plan of Operations Contents and Processing [3809.301-313] [3809.401-412]	BLM review of Notices required in 15 calendar days. Plans, 30 days, with option of 60 more days. Open-ended time frame for Plans for NEPA (EIS), NHPA, and T&E species compliance. Public comment period on EA if BLM determines there is substantial public interest.	Follow state program requirements for content and processing of activities. No BLM processing or decisions,. BLM could comment to state on proposals, just as could any other potentially affected landowner	Expanded detail on Notice and Plan contents. Includes plans for interim management during temporary closures. Operators also required to provide all studies/data BLM needs to comply with NEPA. Review Plan for completeness within 30 days. Notice time frame 15 days. Clarify review time frames begin when complete Notice or Plan is received. Mandatory public comment period on all Plans for at least 30 days.	Same as Alternative 3 but for Plans only.	Same as Alternative 1. Must provide interim management plans for periods of temporary closure.
Modifications [3809.330-331] [3809.430-431]	Operator-initiated modifications are processed similar to original Notice or Plan. Agency-required modifications must show need and that the issue was unforeseen at the time of initial Plan approval.	Conducted according to state requirements.	Eliminated requirement for BLM to show unforeseen issues that warrant modification. BLM may require operator to modify Notice or Plan to prevent unnecessary or undue degradation (UUD). Only test is that the modifica-tion is needed to prevent UUD. Plan modifications required at final closure to address unanticipated conditions or new information.	Same as Alternative 3. All Plans must be renewed every 5 years.	Same as Alternative 3.

Table 2-1. 3809 Regulation Alternatives Summary by Provision

Regulation Issue	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Temporary or Permanent Closure [3809.334] [3809.336] [3809.424]	Site must be maintained in safe and clean condition. May require removal of all structures and equipment, and site reclamation after unspecified period of nonoperation.	Conducted according to state requirements.	Must follow interim management plans during periods of temporary closure. Notices expire after 2 years. BLM may consider projects abandoned, depending on time and condition of sites and equipment. Plans are similar to Notices. After 5 consecutive years of inactivity, Plans may be terminated.	Same as Alternative 3.	Same as Alternative 3.
Financial Guarantee Requirement (Bonding) [3809.500 - .599]	Bonds required only for Plans at BLM's discretion. Expired policy limits bond amounts to $1,000/acre for exploration and $2,000/acre for mining, except for areas with cyanide use or ARD potential which are bonded at 100% estimated BLM reclamation cost. Use state bonding programs to meet these requirements through agreements.	No BLM bonding. The state would set, hold, and administer financial guarantees according to state regulations.	Actual-cost bonding required for all Notices and Plans. Operator would provide initial reclamation cost estimate. Financial guarantee must cover 100% of reclamation costs, including any post-closure water treatment or other site maintenance. Equivalent state bonding instruments could be used to meet requirements, but must be redeemable by the Secretary of the Interior. Discontinue accepting corporate guarantees.	Same as Alternative 3. Bonding would be expanded to cover unplanned events such as spills or facility failures.	Same as Alternative 3.

Table 2-1. 3809 Regulation Alternatives Summary by Provision

Regulation Issue	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Inspection and Monitoring [3809.600]	Operators must allow BLM to inspect operations. Policy is for inspections four times annually where cyanide is used or significant potential for acid rock drainage and twice annually for all other operations. Monitoring programs are developed during Plan review. The operator conducts environmental testing (water, air, soil, etc.) and submits the results to BLM. BLM may take check samples during inspections.	States would conduct inspection and monitoring programs.	Same as Alternative 1. Add: Mandate current policy of inspections four times annually where cyanide is used or potential exists for acid rock drainage. Upon prior notification to BLM, in certain circumstances, may allow the public to annually tour mines.	Same as Alternative 3. Operators would be required to hire independent third parties for environmental monitoring. BLM would be required to take check samples during inspections.	Same as Alternative 1.
Type and Adequacy of Penalties for Non-compliance [3809.700]	BLM issues notices and records of noncompliance. Federal injunctions and criminal prosecution may be used.	State enforcement and penalty programs would be used. BLM would not issue separate penalties. Other agencies would still enforce other laws using their statutory authorities.	Same as Alternative 1. Add: BLM would issue discretionary administrative penalties ($5,000/day), suspensions, revocation of Plan approval, and nullification of Notice for failure to comply with enforcement orders. Under MOUs, BLM would refer certain noncompliance actions to other federal and state agencies for enforcement.	Same as Alternative 3 except enforcement orders and penalties would be mandatory. Operators with unresolved noncompliance could have future permits blocked.	Same as Alternative 3. No additional regulations on criminal penalties. Use current criminal penalties process (Alt. 1).

Table 2-1. 3809 Regulation Alternatives Summary by Provision

Regulation Issue	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Appeals Process [3809.800]	BLM decisions must be appealed within 30 days. Operators must appeal to BLM state director, then to the Interior Board of Land Appeals (IBLA). Third-party appeals of BLM decisions are made to IBLA. BLM's decision is in full force and effect during an appeal, unless IBLA grants a written request for a stay.	Generally there would be no appeals since normally a federal action would not be involved. Where BLM takes an action under some other regulations, such as for rights-of-way, the decision could be appealed under the appeals rules for that program.	Both operator and third parties could request a state director review of any decisions, or appeal directly to IBLA. State director decisions could also be appealed to IBLA. All decisions would be in full force and effect unless a written request for a stay is granted by the reviewing entity (state director or IBLA).	Same as Alternative 3 except that all decisions would be automatically stayed from effect during consideration of the appeal unless a written request for implementation is granted by the reviewing official (state director or IBLA).	No Change. Same as Alternative 1.

77

BLANK

PAGE

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-Issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
General Performance Requirements [3809.420]	Prevent unnecessary or undue degradation. Follow requirements at 3809.1-3(d). Other site-specific requirements may be developed during individual project review.	Mining regulation standards based exclusively on state standards and requirements or those of other federal agencies such as EPA and the Army Corps of Engineers for specific environmental media.	Outcome-based standards with site-specific allowances. Includes BLM cyanide and acid rock drainage requirements. Use proper equipment, devices, and practices. Follow reasonable and customary sequence of exploration, development, and reclamation. Must conduct activities to prevent substantial unmitigatable and irreparable harm to significant resources.	Specify minimum national design standards for exploration, mining, and reclamation. Incorporate BLM policy requirements for cyanide and acid rock drainage. Must conduct activities to prevent irreparable harm to productivity of the land as determined by land use plans.	Same as Alternative 1.
Land Use Plans	Not addressed.	Not addressed.	Consistent with the Mining Law, operations and postmining land use must comply with land use plans.	Same as Alternative 3. BLM would use land use plans to determine resource conditions that constitute irreparable harm.	Same as Alternative 1.

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-Issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Surface and Ground Water Protection	All operators must comply with federal and state water quality standards. Exploration operations and drill hole plugging are not specified.	Same as Alternative 1. State water protection programs and other federal water protection requirements would still apply to operations on BLM-administered lands.	Same as Alternative 1, plus pit water quality must not endanger wildlife, public water supplies, or users. To meet this standard, operators would use operation and reclamation practices that minimize water pollution and changes in flow in preference to water treatment or replacement. All drill cuttings and mud must be contained onsite. All exploration drill holes must be plugged to prevent mixing of waters from aquifers, impacts to beneficial uses, downward water loss, or upward loss from artesian conditions. Bore holes must be plugged on the surface to prevent direct inflow of surface water and to eliminate the open hole as a hazard.	Same as Alternative 3 with these added criteria Pit water quality must not exceed the acute toxicity standard for metals so as not to endanger wildlife, public water supplies, or users. Operators must not need to rely for more than 20 years on water treatment, maintenance, or replacement of lost flow to meet this standard. All drill cuttings and mud must be contained onsite using sumps or portable tanks. All exploration drill holes must be plugged from the bottom to no more than 10 feet of the surface with bentonite or a similar compound to prevent mixing of waters from aquifers, impacts to beneficial uses, downward water loss, or upward loss from artesian conditions. Upper 10 feet must be plugged with cement.	Same as Alternative 1. Project approvals would establish acceptable postclosure water quality conditions for pit lakes suitable to long-term use of the site and those needed to adequately protect ground and surface waters, as well as wildlife and waterfowl.

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-Issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Wetlands and Riparian Area Protection	Not specified. State and 404 permits (from the Army Corps of Engineers) must be acquired for dredging or filling in U.S. waters.	Same as Alternative 1.	Same as Alternative 1 with specific site-selection criteria added: Operator must: (1) avoid locating operations in wetlands and riparian areas where possible, (2) minimize impacts to wetlands and riparian areas, and (3) mitigate damage to wetlands and riparian areas through measures such as restoration or offsite replacement.	Same as Alternative 1 with specific site selection and mitigation criteria: Operator must (1) avoid locating operations in wetlands and riparian areas where possible, (2) minimize impacts to wetlands and riparian areas, and (3) mitigate damage to wetland and riparian areas by restoring to proper functioning condition within 10 years after operations or offsite replacement at a ratio of at least 1.5 acres for every 1 acre disturbed.	Same as Alternative 1.
Soil or Growth Media Handling	Where reasonably practicable, topsoil must be saved and reapplied to disturbed areas after areas have been reshaped.	Topsoil must be salvaged and reapplied according to state standards.	Topsoil or other growth media must be removed, segregated, and preserved for later use in revegetation during reclamation. If topsoil or growth media are of poor quality, other strata or more suitable growth media must be removed, segregated, or preserved in a like manner.	Same as Alternative 3. Topsoil or other growth media must be removed from lands to be disturbed by operations, segregated by soil horizon, and preserved for later use in revegetation during reclamation.	No Change. Same as Alternative 1

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-Issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Revegetation Requirements	Where reasonable and practicable, disturbed areas must be revegetated. Revegetation is to provide a diverse vegetation cover and is a component of the requirement to rehabilitate wildlife habitat. Ban on creating a nuisance would be used to address noxious weed control.	Disturbed areas must be revegetated where reasonable and practicable according to state standards.	Same as Alternative 1 with more specifics on outcome. All disturbed lands must be revegetated to establish a stable and long-lasting cover that is self-sustaining and comparable in both diversity and density to preexisting natural vegetation. Use native species to the extent feasible and establish success according to schedule in reclamation plan. Operations must prevent and control noxious weed infesta-tions.	Same as Alternative 3 with some more design specifics. Canopy cover must be at least 90% that of adjacent undisturbed lands with similar elevation, slope, and aspect at same time of year. Only native species may be used. Operations, including revegetation, must prevent introducing noxious weeds or *eliminate* existing infestations.	No Change. Same as Alternative 1.
Fish, Wildlife and Plant Protection and Habitat Restoration	Operator must act to prevent harm to threatened and endangered species and their habitats that might be affected by operations. Reclamation must include rehabilitating fisheries and wildlife habitat.	Use state standards for protecting fish and wildlife. Taking of a threatened or endangered species or migratory birds would still be prohibited under the Endangered Species Act and Migratory Bird Treaty Act.	Same as Alternative 1. Operators must minimize disturbances and adverse impacts to fish, wildlife, and related environmental values. All processing solutions, reagents, or mine drainage toxic to wildlife must be fenced or netted to prevent wildlife access.	Same as Alternative 3. Operators must minimize disturbance and within 10 years restore disturbed habitat to proper functioning premining condition. Operators must not jeopardize special status species, causing them to be listed as threatened or endangered.	Same as Alternative 1.

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-Issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Protecting Cultural Resources	National Historic Preservation Act Section 106 process used to develop mitigation for cultural resources found before Plan approval. Operators cannot knowingly disturb, alter, injure, or destroy any historical or archaeological site, structure, building, object, or cultural site discovered during operations. Operators must immediately notify BLM of any cultural resources found during operations and must leave such discoveries intact. BLM has 10 working days to protect or remove discovery at the government's cost, after which operations may proceed.	State standards would be used for protecting cultural resources.	Same as Alternative 1, except 30 calendar days instead of 10 working days would be allowed for data recovery. BLM would determine who bears cost of recovery on a case-by-case basis.	Same as Alternative 1, except no time limit would be set on data recovery of significant cultural resources. Operator would bear cost of site recovery.	No Change. Same as Alternative 1.

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Protecting Paleontological Resources	Operators cannot knowingly disturb, alter, injure, or destroy any scientifically important paleontological remains. Operators must immediately notify BLM of any paleontological resources discovered during operations and must leave such discoveries intact. BLM has 10 working days to protect or remove discoveries at the government's cost, after which operations may proceed.	State standards would be used to protect paleontological resources.	Same as Alternative 1, except 30 calendar days instead of 10 working days would be allowed for data recovery. BLM would determine who bears cost of recovery on a case-by-case basis.	Same as Alternative 1, except no time limit on data recovery of significant paleontological resources. Operators would bear cost of site recovery.	No Change. Same as Alternative 1.
Protecting Cave Resources	Not specified.	Use state standards for protecting cave resources.	Inventories and mitigation plans would be required before disturbance of cave resources. Operators must immediately notify BLM of any significant cave resources found during operations and leave such discoveries intact. BLM has 30 calendar days to protect a discovery, after which operations may proceed. BLM would determine who bears the cost for protecting cave resources.	Same as Alternative 3, except there would be no time limit on data recovery of significant cave resources Operator would bear cost of cave resource protection.	No Change. Same as Alternative 1.

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives					
Performance Standards Sub-Issues	**Alternative 1: Existing Regulations (No Action)**	**Alternative 2: State Management**	**Alternative 3: Proposed Regulations (Preferred Alternative)**	**Alternative 4: Maximum Protection**	**Alternative 5: NRC Recommendations**
American Indian Traditional Cultural Values, Practices, and Resources	Not specified in regulations. Consultation with American Indians is used to develop mitigation on a case-by-case basis.	State standards would be used to protect American Indian resources. BLM would help American Indians consult with states on a specific project's impacts.	Consultation with American Indians is specified as part of Plan review process. Consultation would be used to develop mitigation on a case-by-case basis where mitigation is possible.	Plan approval in special status areas, designated through the land use planning process as containing American Indian traditional cultural values, would require concurrence by affected American Indians.	No Change. Same as Alternative 1.
Roads and Structures	Minimize surface disturbance, use existing access where practical, maintain safe design, follow natural contour, minimize cut and fill. Operators must consult with BLM for roadcuts greater than 3 feet on inside edge. All structures must be built and maintained according to state and local codes. Structures are addressed in separate rules at 43 CFR 3715.	Roads would be built and maintained according to state standards. Same as Alternative 1 for structures on BLM lands.	Same as Alternative 1. (Consultation not specified for roadcuts greater than 3 feet.)	Roads built for access, haulage, service, or exploration must not have maximum sustained grade greater than 10%, with short pitches of less than 300 feet to take advantage of topography not to exceed a 12% grade. Diagonal drainage barriers must be placed as follows: Grade % — Max. Spacing (ft) 0 - 2 — 200 3 - 8 — 150 9 -12 — 80 All roads must be reclaimed to approximately original contour. All structures must be built and operated according to codes and removed at the end of operations.	No Change. Same as Alternative 1.

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-Issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Handling of Potentially Acid-Forming, Toxic, or Other Deleterious Materials	Reclamation must include measures to isolate, remove, or control toxic or deleterious materials. Other requirements imposed would be based on site-specific review according to BLM policies [acid rock drainage (ARD) policy].	Potentially acid-forming material must be managed according to state requirements. No discharges could exceed state and federal effluent limits under the Clean Water Act or state water quality acts.	Same as Alternatives 1 and 2 plus incorporate ARD policy. Static or kinetic testing must be used to identify and guide handling and placement of potentially acid-forming materials. ARD control measures must be fully integrated with operational procedures, facility design, and environmental monitoring programs. ARD control must focus on prevention or control of acid-forming reaction. If formation of ARD cannot be prevented, its potential migration must be prevented or controlled. Capture and treatment of ARD or other undesirable effluent is required if source controls and migration controls do not prove effective. Effluent treatment could be used only after source control has been employed.	Same as Alternative 3 with more design specifics and suitability criteria. BLM could set criteria to determine if deposits are unsuitable for mining because of acid-forming and acid-neutralizing mineral content, climate, and available control technologies. BLM would not approve mining of materials exceeding these criteria. Potentially toxic mine wastes (pond sludge, lab wastes) could not be disposed of on BLM-managed lands. Plans proposing treatment periods longer than 20 years to meet standards are not acceptable and would be denied.	No Change. Same as Alternative 1.

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Leaching and Processing Operations and Impoundment	Reclamation must include measures to isolate, remove, or control toxic or deleterious materials. Other requirements imposed would be based on site-specific review according to BLM policies [cyanide management policy, BLM state cyanide management plans, and acid rock drainage (ARD) policy].	Leaching and processing operations must be designed, built, and operated according to state standards.	Same as Alternatives 1 and 2 plus includes BLM's cyanide policy: Cyanide facilities must be able to contain maximum operating solution with capacity for the 100-year, 24-hour storm event, including snowmelt events and expected draindown from heaps during power outages. Secondary containment required for vats, tanks, or recovery circuits to prevent release of toxic solutions. Heaps and other solution containment structures must be monitored for leaks. Cyanide solution and heaps must be detoxified upon release to the environment, at temporary closure, or at final reclamation. Operations must not cause wildlife mortality. Exposed cyanide solutions must be fenced and covered to prevent access by public, wildlife, and livestock. Neutralization may be used in lieu of fencing tailings impoundments.	Same as Alternative 3, plus: Design for probable maximum precipitation event. Secondary containment system around vats, tanks, or recovery circuits must be adequate to contain 110% of the maximum contents. All leach pads must employ at least two synthetic liners with drainage layer over at least 24-inches of compacted clay. Each synthetic liner must be at least 40 mils thick. The clay liner must be compacted to a permeability of less than 1X10^{-7} cm/sec. Leak detection and recovery systems must be built for heaps and other solution containment structures. Ore heap and leach pads must have a minimum factor of safety of 1.3 and be stable during construction. Cyanidated material must be detoxified at temporary or final closure to less than 0.2 mg/l WAD cyanide, pH between 6.0 and 8.5, and metal levels less than the MCLs. Post-closure discharges must achieve levels acceptable to the state and EPA.	No Change. Same as Alternative 1.

Table 2-1. 3809 Regulations Summary of Performance Standards by Alternatives

Performance Standards Sub-issues	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5: NRC Recommendations
Stability, Grading, and Erosion Control	Reclamation must include measures to control erosion, landslides, and runoff.	Stability, grading, and erosion control must be achieved according to state regulations.	Erosion must be minimized during all phases of operations. All disturbed areas must be graded or otherwise engineered to a stable condition to minimize erosion and facilitate revegetation. All areas must be recontoured to blend in with the premining natural topography to the extent practical.	Erosion must be controlled so that soil loss does not exceed 2 tons/acre/year. All excavations (roadcuts, drillsites, etc.) Must be recontoured to about the original contour. Recontoured waste rock and spent ore must be graded to no steeper than 3h:1v.	No Change. Same as Alternative 1.
Pit Backfilling and Reclamation	Not specified. Stable highwall might be left where required to preserve evidence of mineralization.	Backfilling or reclaiming of mine pits would comply with state requirements.	BLM would determine degree of backfilling required, if any, from a site-specific operator demonstration of feasibility based on economic, environmental, and safety considerations. Mitigation would be required for pit areas that are not backfilled.	Backfilling of mine pits presumed. Only exemption from backfilling would be where found environmentally unsound or unsafe. Mitigation would be required for pit areas that are not backfilled	No Change. Same as Alternative 1. Amount of pit backfilling determined on a case-by-case basis.

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Casual Use Definition / Suction Dredging [3809.5]	Activities resulting in only negligible surface disturbance and not involving mechanized earthmoving equipment, explosives, or vehicle use in areas closed to off-road vehicles. IBLA has recently ruled that suction dredging is not casual use.	Cumulative impacts could exceed casual use level. Regulations would specify that small suction dredges could be casual use. BLM would not require a Notice or Plan for suction dredging if a state permit is required and BLM has a MOU with the state on suction dredging.	The Committee favors retaining the BLM distinction for casual use operations...(pg. 95) The Committee believes that BLM...is appropriately regulating these small suction dredging operations under the current regulations as casual use...(pg. 96).
Definition of Project Area [3809.5]	A tract of land upon which operations are conducted. Includes the area required for building or maintenance of roads, transmission lines, pipelines, or other means of access. Project area may include one or more mining claims, but claims must be under one ownership.	Change would not specify that the mining claims involved in a project be under single ownership.	
Definition of Public Lands (Lands where the regulations would apply) [3809.5]	BLM-administered lands subject to the Mining Law. Does not include lands where only the minerals or surface is federal, except that amendments to the Stock Raising Homestead Act require BLM's involvement when surface owner does not consent to mineral development.	Expand definition to include lands where mineral estate is federal, subject to the Mining Law, and the surface estate is private under the Stock Raising Homestead Act. Lands with reserved minerals from a sale or exchange could be open to the operation of the Mining Law through a land use plan.	

88

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	**Existing 3809 Regulations (Alternative 1)**	**Proposed Final 3809 Regulations (Alternative 3)**	**NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)**
***Unnecessary or Undue Degradation* Definition (UUD) [3809.5]**	Prudent operator standard. Follow "usual, customary, and proficient" measures. Mitigate impacts. Comply with environ-mental laws. Perform reclamation. Do not create a nuisance.	Replace the prudent operator standard with requirement to comply with performance standards. All activity must be reasonably incident to prospecting, mining, or processing operations. Add to definition: conditions, practices, or activities that cause substantial irreparable harm to significant scientific, cultural, or environmental resource values that cannot be effectively mitigated.	**Recommendation 15:** BLM should prepare guidance manuals and conduct staff training to communicate the agency's authority to protect valuable resources that may not be protected by other laws. (pg. 120) [S]The current regulatory definition of UUD does not explicitly provide authority to protect valuable or sensitive resources that are not protected by other laws. Some resources may deserve to be protected from all impacts, while other resources may withstand some impacts with associated mitigation. (pgs. 69 & 121)
Notice vs. Plan of Operations Threshold [3809.11]	Surface disturbance of less than 5 acres per calendar year requires a Notice. A Plan is required for more than 5 acres a year of disturbance or for any activity exceeding casual use in special status areas such as areas of critical environ-mental concern, the California Desert Conservation Area, wild and scenic rivers, wilderness areas, and areas closed to off-road vehicles.	Change threshold on the basis of division between exploration and mining. All mining, milling, and bulk sampling over 1,000 tons would require Plans. Exploration disturbing less than 5 acres would require Notices. Exploration in special status lands or disturbing more than 5 acres would require Plans. Expand special status lands to include: national monuments/conservation areas, and lands containing proposed or listed T&E species or their critical habitat.	**Recommendation 2:** Plans of operations should be required for mining and milling operations, other than those classified as casual use or exploration activities, even if the area disturbed is less than 5 acres. (pg. 95) ...the Committee believes a Plan of operations should generally be required for activities involving bulk sampling. (pg. 96) [S] With financial assurance the 5-acre threshold appears reasonable for requiring exploration disturbance to go to a Plan of operations. (pg. 99)

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Mining Claim Validity, Existing Rights, and Mine Economics [3809.100]	Not addressed in 3809 regs. Validity exams required before Plan approval in wilderness areas per the 8560 regulations. BLM has option of determining valid existing rights before approving Plans in segregated or withdrawn areas.	Add requirement that validity exams be conducted to determine valid existing rights before approval of Plans in areas withdrawn from operation of mining laws. Discretion to perform validity exams for segregated lands.	
Common Variety Minerals [3809.101]	Not addressed in 3809 regs. Policy provides for holding escrow during operations if materials to be mined may be of a common variety and subject to payment of fair market value.	Regulations would provide for holding escrow during operations if materials to be mined may be of a common variety and subject to payment of fair market value.	
State and Federal Government Coordination [3809.201 - .204]	Memorandums of understanding (MOUs) with each state provide for coordination for review, approval, bonding, monitoring, and enforcement. States may have lead for some program elements. Most restrictive requirements (BLM or state) apply.	When requested, BLM *must* give states the lead where state program is at least as strict as BLM requirements. BLM must concur on Plan approvals. BLM retains inspection and enforcement option and NEPA, NHPA, Tribal Gov't-Gov't coordination and T&E species responsibilities.	Given the variation in topography, climate, and area of federal lands open to hardrock mining in any state, differences in state laws, and local differences in public attitudes toward mining, consistency among state MOUs may not be necessary or even desirable. (pg. 52)

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Applying Regulation Changes to Existing Operations [3809.300] [3809.400]	Not applicable.	Existing Notices would expire after 2 years unless bonded and extended. Existing Notices for mining need not be refiled as Plans if disturbance area does not increase. Existing Plans, pending Plans, or Plan modifications are not required to comply with the new performance standards if filed before the effective date of new regulations. All Plans would have to meet the bonding requirements within 180 days of the effective date of the new regulations. New mine facilities added to existing Plans or modifications to existing mine facilities would have to comply with the new regulations unless shown not to be practical for economic, environmental, safety, or technical reasons.	

91

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Notice and Plan of Operations Contents and Processing [3809.301 - .313] [3809.401 - .412]	BLM review of Notices required in 15 calendar days and of Plans in 30 days, with option of 60 more days. Open-ended time frame for Plans for NEPA (EIS), NHPA, and T&E species compliance. Public comment period on EA if BLM determines there is substantial public interest.	Expanded detail on Notice and Plan contents. Includes plans for interim management during temporary closures. Operators required to provide all studies/data BLM needs to comply with NEPA. Review Plan for completeness within 30 days. Notice time frame is 15 days. Clarify review time frames begin when a complete Notice or Plan is received. Mandatory public comment period on all Plans for at least 30 days.	[S] With adequate bonding for reclamation, small miners should receive expedited permits. (pg. 98) ...the current BLM 3809 regulation with a 15-day response time for Notice-level exploration should be maintained... (pg. 98). **Recommendation 10:** From the earliest stages of the NEPA process, all agencies with jurisdiction over mining operations or affected resources should be required to cooperate effectively in the scoping, preparation, and review of environmental impact assessments for new mines. Tribes and nongovernmental organizations should be encouraged to participate and should participate from the earliest stages. (pg. 111) [BLM] should develop procedures that will enable them to identify, in the review and approval process for plans of operations, the kinds of post-mining requirements that are likely to arise and to incorporate these into the approved plan of operations. (pg. 120) **Recommendation 16:** BLM...should plan for and implement a more timely permitting process, while still protecting the environment. (pg.122) [S]The lead agency should set and achieve deadlines and have sufficient qualified staff to do so....Recommendations that support more efficient reviews and permitting include 1, 2, 6, 10, 11, & 12. Information on the time involved in recent reviews should be compiled and studied to identify causes for delays. (pg. 123)

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Modifications **[3809.330-331]** **[3809.430-431]**	Operator-initiated modifications are processed like original Notice or Plan. Agency-required modifications must show need and that the issue was unforeseen at the time of initial Plan approval.	Eliminates requirement for BLM to demonstrate unforeseen issues that warrant modification. BLM may require operator to modify Notice or Plan to prevent unnecessary or undue degradation (UUD). Only test is that the modification is needed to prevent UUD. Plan modifications required at final closure to address unexpected conditions or new information.	Recommendation 4: BLM...should revise their regulations to provide more effective criteria for modifications to Plans, where necessary, to protect federal lands. (pg. 99) Staff comments and documents reviewed by the Committee suggest that the regulations should be modified to improve criteria for modifications, require periodic reviews, and /or specify expiration dates for approved plans of operations to assure the opportunity to adjust practices where needed. (pg. 100) The Committee did not determine if plans of operations should be reviewed or reopened at predetermined intervals. (pg 101) Financial assurance instruments should also be updated as conditions change that might affect the levels of bonding or other forms of financial assurance. (pg. 101)

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Temporary or Permanent Closure [3809.334 3809.424]	Site must be maintained in safe and clean condition. May require removal of all structures and equipment and reclaiming of site after an unspecified period of nonoperation.	Must follow interim management plans during periods of temporary closure. Notices expire after 2 years. BLM may consider the project abandoned, depending on time and condition of site and equipment. Plans are similar to Notices. After 5 consecu-tive years of inactivity the Plan may be terminated.	**Recommendation 5:** BLM...should adopt consistent regulations that a) define the conditions under which mines will be considered to be temporarily closed; b) require that interim management plans be submitted for such periods; and c) define the conditions under which temporary closure becomes permanent and all reclamation closure requirements must be completed. (pg.101) **Recommendation 14:** BLM...should plan for and assure the long-term post-closure management of mine sites on federal lands. (pg 118). [S]BLM should consider land uses appropriate for closed and reclaimed mines, and whether any uses should be controlled or precluded. Management requirements need to address and assure: future mineral access, maintaining measures to protect the public from safety hazards, measures to assure integrity of closed waste units including monitoring and repair, long-term environmental monitoring with corrective measures programs, operation and maintenance of water treatment facilities needed to maintain water quality compliance over the long term, and financial assurance to ensure implementation of these post-closure management requirements. (pg. 119)

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Financial Guarantee Requirements (Bonding) [3809.500 - .599]	Bonds required only for Plans at BLM's discretion. Expired policy limits bond amounts to $1,000/acre for exploration and $2,000/acre for mining, except for areas with cyanide use or ARD potential which are bonded at 100% estimated BLM reclamation cost. Use state bonding programs to meet these requirements through agreements.	Actual-cost bonding required for all Notices in addition to Plans. Operator would give initial reclamation cost estimate. Financial guarantee must cover 100% of the reclamation costs, including any postclosure water treatment or other site maintenance. Existing Plans must provide financial assurance within 180 days of effective date of new regulations Equivalent state bonding instruments could be used to meet requirements but must be redeemable by the Secretary of the Interior. Discontinue accepting corporate guarantees.	Financial Guarantees - The various finanacial mechanisms should be secure and sufficiently liquid to allow responses to near-term needs. (pg 61) Based on the Committee's findings, inadequate protection of the public and the environment caused by current financial assurance procedures is a gap in the regulatory programs. (pg. 65) Financial risks to the public and environmental risks to the land exist whenever secure financial assurances are lacking. (pg. 90) **Recommendation 1:** Financial assurance should be required for reclamation of disturbances to the environment caused by all mining activities beyond those classified as casual use, even if the area disturbed is less than five acres. (pg.93). The objective of this recommendation is to guarantee financial assurance for all significant disturbances. (pg. 94) Standard bond amounts for certain types of activities on specific kinds of terrain should be established by [BLM]...A set of activity-and terrain-dependent standard bond amounts...should be established for typical activities... Standard bond amounts... should be used in lieu of detailed calculations...based on the engineering design of a mine or mill. (pgs. 94-95) ...the Committee encourages the use of bond pools to lessen the financial burden on small miners. (pg. 95) The Committee does not intend that bonding of exploration activities result in a federal action that would automatically trigger an EA or EIS.(pg.99) Appropriate types of financial assurance should be investigated for long-term water treatment (pg.120).

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	**Existing 3809 Regulations (Alternative 1)**	**Proposed Final 3809 Regulations (Alternative 3)**	**NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)**
Inspection and Monitoring [3809.600]	Operator must allow BLM to inspect operations. Policy is for inspections four times annually where cyanide is used or significant potential exists for acid rock drainage and twice annually for all other operations. Monitoring programs are developed during Plan review. The operator conducts environmental testing (water, air, soil, etc.) and submits the results to BLM. BLM may take check samples during inspections.	Same as Alternative 1. Add: Mandate current policy of inspections four times annually where cyanide is used or the potential exists for acid rock drainage. Upon prior notification to BLM, in certain circumstances, may allow the public to annually tour mining operations.	Post-Closure Issues...An important part of long-term management will be monitoring, inspection, and low-level maintenance of reclamation features, such as soil covers, vegetation, closed impoundments, waste rock piles, and water diversion structures. In some cases the quality of surface water or groundwater must also be monitored. (pg. 84)
Type and Adequacy of Penalties for Non-compliance [3809.700]	BLM issues notices of noncompliance and records of noncompliance. Federal injunctions and criminal prosecution may be used.	Same as Alternative 1. Add: BLM would issue discretion-ary administrative penalties ($5,000/day), suspensions, revocation of Plan approval, and nullification of Notice for failure to comply with enforce-ment orders. Under MOUs, BLM would refer certain noncompliance actions to other federal and state agencies for enforcement.	**Recommendation 6:** ...BLM... should have both (1) authority to issue administrative penalties for violations of their regulatory requirements, subject to appropriate due process, and (2) clear procedures for referring activities to other federal and state agencies for enforcement. (pg. 102)
Appeals Process [3809.800]	BLM decisions must be appealed within 30 days. Operator must appeal to BLM state director, whose decisions may be appealed to the Interior Board of Land Appeals (IBLA). Third-party appeals of BLM decisions are made directly to IBLA. Decisions appealed to IBLA are in full force and effect unless IBLA grants a written request for a stay.	Both operator and third-party appeals would be to IBLA. *State director appeals would be provided for.* All decisions would be in full force and effect unless a the reviewing entity (either state director or IBLA) grants a written request for a stay.	

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
General Performance Standard Requirements [3809.420]	Prevent unnecessary or undue degradation. Follow requirements at 3809.1-3(d). Other site-specific requirements may be developed during individual project review.	Outcome-based standards with site-specific allowances. Includes BLM cyanide and acid rock drainage requirements. Use proper equipment, devices, and practices. Follow reasonable and customary sequence of exploration, development, and reclamation. Must conduct activities to prevent substantial irreparable and unmitigatable harm to significant resources.	**Recommendation 9:** BLM...should continue to base their permitting decisions on the site-specific evaluation process provided by NEPA. The... [agency] should continue to use comprehensive performance-based standards rather than using rigid, technically prescriptive standards....[BLM] should regularly update technical and policy guidance documents to clarify how statutes and regulations should be interpreted and enforced. (pg. 108) Although mining operations are regulated by a variety of environmental protection laws...these laws may not adequately protect all the valuable environmental resources..Examples of resources that may not be adequately protected include springs, seeps, riparian habitat, ephemeral streams, and certain types of wildlife. (pg. 121)
Land Use Plans	Not addressed.	Consistent with the Mining Law, operations and postmining land use must comply with the land use plan.	Note: these recommendations are directed at BLM's planning process and not at any direct change in the 3809 regulations. **Recommendation 13:** BLM... should identify, regularly update, and make available to the public, information identifying those parts of federal lands that will require special consideration in land use decisions because of natural and cultural resources or special environmental sensitivities. (pg. 117) ...provisions should be made to amend or clarify, as necessary, applicable land use plans to reflect the post-closure requirements of the site and to consider institutional, management, staffing, and other needs of the post-closure mine site. (pg.120)

97

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Surface and Ground Water Protection	All operators must comply with federal and state water quality standards. Exploration operations and drill hole plugging are not specified.	Same as Alternative 1, plus pit water quality must not endanger wildlife, public water supplies, or users. To meet this standard, operation and reclamation practices that minimize water pollution and changes in flow would be used in preference to water treatment or replacement. All drill cuttings and mud must be contained onsite. All exploration drill holes must be plugged to prevent mixing of waters from aquifers, impacts to beneficial uses, downward water loss, or upward loss from artesian conditions. Bore holes must be plugged on the surface to prevent direct inflow of surface water and to eliminate the open hole as a hazard.	The Committee concluded that pit lake water quality should be subject to regulation and not simply left to chance. However, the committee had difficulty identifying a universal approach suitable for the classification of all pit lakes... Project approvals should clearly establish acceptable post-closure water quality conditions appropriate to long-term use of the site and those that provide adequate protection for ground and surface waters, as well as wildlife and waterfowl. (pg. 109). Although mining operations are regulated by a variety of environmental protection laws...these laws may not adequately protect all the valuable environmental resources..Examples of resources that may not be adequately protected include springs, seeps, riparian habitat, ephemeral streams, and certain types of wildlife. (pg. 121)
Wetlands and Riparian Area Protection	Not specified. State and 404 permits (from the Army Corps of Engineers) must be acquired for dredging or filling in U.S. waters.	Same as Alternative 1 with specific site-selection criteria added: Operator must (1) avoid locating operations in wetland and riparian areas where possible, (2) minimize impacts to wetlands and riparian areas, and (3) mitigate damage to wetland and riparian areas through measures such as restoration or offsite replacement.	Use of such [advisory] guidelines is consistent with the principle that regulatory decisions should be based on site-specific evaluations and conditions. For instance, in many areas of the western U.S., healthy riparian habitat is scarce and has high value for wildlife or as a buffer to protect stream quality. In these cases, the flexible regulatory framework would suggest that riparian areas should be valued and be provided reasonable protection in site-specific decisions (pgs. 68-69). Although mining operations are regulated by a variety of environmental protection laws...these laws may not adequately protect all the valuable environmental resources..Examples of resources that may not be adequately protected include springs, seeps, riparian habitat, ephemeral streams, and certain types of wildlife. (pg. 121)

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Soil or Growth Media Handling	Where reasonably practicable, topsoil must be saved and reapplied to disturbed areas after they have been reshaped.	Topsoil or other growth media must be removed from lands to be disturbed and segregated and preserved for later use in revegetation during reclamation. If topsoil or growth media are of such poor quality so as not to be reasonably effective in sustaining revegetation, other strata or more suitable growth media must be removed, segregated, or preserved in a like manner.	
Revegetation Requirements	Where reasonable and practicable, disturbed areas must be revegetated. Revegetation is to provide a diverse vegetation cover. Revegetation is a component of the requirement to rehabilitate wildlife habitat. Prohibition on creation of a nuisance used to address noxious weed control.	Same as Alternative 1 with more specifics on outcome. All disturbed lands must be revegetated to establish a stable and long-lasting cover that is self-sustaining and comparable in both diversity and density to preexisting natural vegetation. Use native species to the extent feasible and establish success according to the schedule in the reclamation plan. Operations must prevent and control noxious weed infestations.	
Fish, Wildlife and Plant Protection and Habitat Restoration	Operators must act to prevent harm to threatened and endangered species and their habitats that might be affected by operations. Reclamation must include rehabilitating fisheries and wildlife habitat.	Same as Alternative 1. Operators must minimize disturbances and adverse impacts to fish, wildlife, and related environmental values. All processing solutions, reagents, or mine drainage toxic to wildlife must be fenced or netted to prevent wildlife access.	Although mining operations are regulated by a variety of environmental protection laws...these laws may not adequately protect all the valuable environmental resources..Examples of resources that may not be adequately protected include springs, seeps, riparian habitat, ephemeral streams, and certain types of wildlife. (pg. 121)

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Protecting Cultural Resources	National Historic Preservation Act Section 106 process is used to develop mitigation for cultural resources found before Plan approval. Operators cannot knowingly disturb, alter, injure, or destroy any historical or archaeological site, structure, building, object, or cultural site discovered during operations. Operators must immediately notify BLM of any cultural resources found during operations and must leave such discoveries intact. BLM has 10 working days to protect or remove the discovery at the government's expense, after which operations may proceed.	Same as Alternative 1, except 30 calendar days instead of 10 working days would be allowed for data recovery. BLM would determine who bears the cost of recovery on a case-by-case basis.	
Protecting Paleontological Resources	Operators cannot knowingly disturb, alter, injure, or destroy any scientifically important paleontological remains. Operators must immediately notify BLM of any paleontological resources discovered during operations and must leave such discoveries intact. BLM has 10 working days to protect or remove the discoveries at the government's expense, after which operations may proceed.	Same as Alternative 1, except 30 calendar days instead of 10 working days would be allowed for data recovery. BLM would determine who bears the cost of recovery on a case-by-case basis.	

100

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	**Existing 3809 Regulations (Alternative 1)**	**Proposed Final 3809 Regulations (Alternative 3)**	**NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)**
Protecting Cave Resources	Not specified.	Inventories and mitigation plans would be required before disturbance of cave resources. Operators must immediately notify BLM of any significant cave resources found during opera-tions and leave such discoveries intact. BLM has 30 calendar days to protect a discovery, after which operations may proceed. BLM would determine who bears the cost for protecting cave resources.	
American Indian Traditional Cultural Values, Practices, and Resources	Not specified in the regulations. Consultation with American Indians is used to develop mitigation on a case-by-case basis.	Consultation with American Indians is specified as part of the Plan review process. Consultation would be used to develop mitigation on a case-by-case basis where mitigation is possible.	Recommendation 10: ... Tribes ... should be encouraged to participate [in new mine permitting] and should participate from the earliest stages. (pg. 111)
Roads and Structures	Minimize surface disturbance, use existing access where practical, maintain safe design, follow natural contours, minimize cuts and fills. Operators must consult with BLM for roadcuts greater than 3 feet on the inside edge. All structures must be built and maintained according to state and local codes. Structures are addressed in separate rules at 43 CFR 3715.	Same as Alternative 1. (Consultation not specified for roadcuts greater than 3 feet.)	

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Handling of Potentially Acid-Forming, Toxic, or Other Deleterious Materials	Reclamation must include measures to isolate, remove, or control toxic or deleterious materials. Other requirements imposed would be based on site-specific review according to BLM policies [acid rock drainage (ARD) policy].	Same as Alternatives 1 and 2 plus: incorporate ARD policy. Static or kinetic testing must be used to identify and guide the handling and placement of potentially acid-forming materials. ARD control measures must be fully integrated with operational procedures, facility design, and environmental monitoring programs. ARD control must focus on prevention or control of the acid-forming reaction. If formation of ARD cannot be prevented, its potential migration must be prevented or controlled. Capture and treatment of ARD or other undesirable effluent is required if source controls and migration controls do not prove effective. Effluent treatment could be used only after source control has been employed.	

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Leaching and Processing Operations and Impoundments	Reclamation must include measures to isolate, remove, or control toxic or deleterious materials. Other requirements imposed would be based on site-specific review according to BLM policies (cyanide management policy, BLM state cyanide management plans, and ARD policy)	Same as Alternatives 1 and 2 plus includes BLM's cyanide policy: Cyanide facilities must be able to contain the maximum operating solution with capacity for the 100-year, 24-hour storm event, including snowmelt events and expected draindown from heaps during power outages. Secondary containment required for vats, tanks, or recovery circuits to prevent the release of toxic solutions. Heaps and other solution containment structures must be monitored for leaks. Cyanide solution and heaps must be detoxified upon release to the environment, temporary closure, or at final reclamation. Operations must not cause wildlife mortality. Exposed cyanide solutions must be fenced and covered to prevent access by the public, wildlife, and livestock. Neutralization may be used in lieu of fencing tailings impoundments.	
Stability, Grading and Erosion Control	Reclamation must include measures to control erosion, landslides, and runoff.	Erosion must be minimized during all phases of operations. All disturbed areas must be graded or otherwise engineered to a stable condition to minimize erosion and facilitate revegetation. All areas must be recontoured to blend in with the premining natural topography to the extent practical.	

Table 2-2. Existing and Final Proposed 3809 Regulations as Compared to the NRC Report

Regulation Topic	Existing 3809 Regulations (Alternative 1)	Proposed Final 3809 Regulations (Alternative 3)	NRC Study Committee Conclusions or Recommendations (From: *Hardrock Mining on Federal Lands*, NRC 1999)
Pit Backfilling and Reclamation	Not specified. Stable highwall might be left where required to preserve evidence of mineralization.	BLM would determine degree of backfilling required, if any, from a site-specific operator demonstration of feasibility based on economic, environmental, and safety considerations. Mitigation would be required for pit areas that are not backfilled.	If backfilling of mines is to be considered, it should be determined on a case-by-case basis as was concluded by the COSMAR report (NRC, 1979). Site specific conditions are too variable for prescriptive regulation (pg. 90).

Page numbers are from the National Resource Council's *Hardrock Mining on Federal Lands* (NRC 1999).

Excerpts are taken nearly verbatim from the above cited report. "[S]" denotes where report text has been summarized.

A blank in the right-hand column shows no specific NRC conclusions or recommendations on the existing 3809 regulations or program. NRC made several general conclusions: (1) Existing regulations are generally well coordinated, although some changes are necessary, and (2) Improvements in the implementation of the existing regulations present the greatest opportunity for improving environmental protection and the efficiency of the regulatory process.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
MINERAL EXPLORATION AND DEVELOPMENT					
Common to all Alternatives	Increases in cost to mineral development will continue due to changing regulatory environment.				
Casual Use	High-use areas could continue to endure cumulative impacts that would cause unnecessary or undue degradation.	Depending on the state program, operations might or might not be reviewed. Disturbance might not be reclaimed. Operations would not be delayed or added costs incurred.	High-use areas would be reviewed, and if cumulative impacts are not negligible, they could be protected by land use plan designation. Notices or Plans would be required. Requiring suction dredge operators to contact BLM would delay activity, increase operation costs, and restrict access of small miners and recreationists to minerals.	All casual use operators would have to contact BLM to determine the potential level of operation, casual use or Plan of Operations, possibly delaying operations and increasing operation costs. Access of small miners and recreationists to minerals would be restricted.	Same as Alternative 1.
Notices	Notices would not be subjected to bonding, and some future operations might not be reclaimed.	Depending on the state program, operations might or might not be reviewed. Disturbance might not be reclaimed. Operations would not be delayed or added costs incurred.	Notices only for exploration would drive up costs for small mine operators. Bonding of Notices would increase exploration costs and reduce exploration activity.	No Notices would be allowed.	Same as Alternative 3.

105

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
MINERAL EXPLORATION AND DEVELOPMENT (continued)					
Plans of Operations	Not bonding all Plans of Operation at 100% of reclamation costs could result in insufficient funds to perform reclamation if an operator files bankruptcy or refuses to perform reclamation. Common variety minerals could be mined under the Mining Law, and Federal Government could lose royalties. Withdrawn lands could have operations proceed in sensitive areas.	Depending on the State program, operations might or might not be reviewed, and environmental concerns might not get identified. Bonding might not be adequate to ensure reclamation performance. Same as Alternative 1. Same as Alternative 1.	Using a Plan of Operations to review all mines would increase likelihood that operations would meet the performance standards. Costs and workload for operators and BLM would increase. Bonds for reclamation should be adequate to ensure reclamation. Potential royalties for common variety minerals would be protected through establishment of an escrow account. Validity exams would ensure that surface disturbance did not occur in withdrawn lands without prior valid existing mining claims.	Requiring a Plan of Operations for all activity other than casual use would increase BLM workload and industry cost and cause delays. Bonds would be adequate to ensure reclamation performance and fund remediation of unplanned events. Requiring validity exams for all common variety minerals and withdrawn land areas before operations are approved would increase costs to industry, increase BLM workload and delay operations.	Same as Alternative 3. Same as Alternative 1 for common variety minerals and operations in withdrawn lands.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
MINERAL EXPLORATION AND DEVELOPMENT (continued)					
Inspection and Enforcement	Inspection would be based on policies, and enforcement would continue to be difficult. Operation might not have to reclaim because of enforcement delays.	Depending on the state program, inspection and enforcement might be limited. State organizations might not have resources to enforce requirements.	Inspection would be standardized, and the enforcement procedure would have the additional penalties tool to be used if needed. Reclamation and on-the-ground activities would be responded to in a timely manner.	Operations would have to hire a third-party contractor to do some of inspections, and penalties would be assessed automatically, costing industry time and money and increasing BLM's workload. Relationships between BLM and industry could be strained.	Same as Alternative 3.
Exploration	There would be no change to the costs for exploration activity.	Exploration costs could decrease depending on state program requirements. There would be fewer limitations on access to mineral exploration areas.	Exploration operations would continue to explore and not experience large delays. The requirement would increase the costs of operations and could economically harm small independent geologists and prospectors, who might also have difficulty obtaining bonds. Suction dredge operations would decrease, or, alternatively, trespass from suction dredging would increase on public lands.	Exploration projects would be delayed and costs would increase. Operators would find it difficult to modify the project in a timely manner. Increased costs could economically harm small independent geologists and prospectors. Since operations could be denied because of environmental concerns, the uncertainty of development of mineral properties could make industry unwilling to take the financial risk, even for exploration.	Exploration operations would continue to explore and not experience large delays. The requirement would increase the costs of operations and could economically harm small independent geologists and prospectors, who might also have difficulty obtaining bonds.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
MINERAL EXPLORATION AND DEVELOPMENT (continued)					
Mining	Mining would not undergo added costs or delays.	Cost of operations could decrease depending on the state program. There could be fewer or more limitations in requirements and in access.	Requiring Plans of Operations for all mining would increase costs and delays in projects. Many small operators could have difficulty providing a bond for Plan-level operations and meeting the environmental requirements. Bonds would be more difficult for larger operators to obtain because corporate guarantees would be discontinued. The uncertainty of development of mineral properties because of the substantial irreparable harm provision could make industry unwilling to take the financial risk, even for exploration.	Requiring Plans of Operations for all activity would increase costs and delays in projects. Many small operators would have difficulty providing a bond for Plan-level operations and meeting the environmental requirements. Bonds would be more difficult for larger operators to obtain because corporate guarantees would discontinued. The uncertainty of development of mineral properties because of the substantial irreparable harm provision could make industry unwilling to take the financial risk, even for exploration.	Requiring Plans of Operations for all mining would increase costs and delays in projects. Many small operators could have difficulty providing a bond for Plan-level operations and meeting the environmental requirements. Bonds would be more difficult for larger operators to obtain because corporate guarantees would discontinued.
CHANGES IN MINERAL ACTIVITY					
Casual Use/ Suction Dredging	Current levels not established.	No change.	5 to 10% overall decrease. 10 to 25% decrease in suction dredging.	40 to 50% overall decrease. 70 to 90% decrease in suction dredging.	No change.
Exploration	7,560 Notices 870 Plans	7,560 - 7,940 Notice level 870 - 910 Plan level	6,050 - 6,800 Notices 700 - 740 Plans	6,910 - 6,750 Plans	7,180 - 7,560 Notices 830 - 870 Plans

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
CHANGES IN MINERAL ACTIVITY (continued)					
Placer Mines (20yrs.)	2,520 Notices 750 Plans	2,650 - 2,520 Notice level 790 - 750 Plan level	0 Notices 2,650 - 2,980 Plans	2,650 - 2,330 Plans	0 Notices 2,980 - 3,140 Plans
Open Pit Mines (20yrs.)	1,080 Notices 1,050 Plans	1,080 - 1,130 Notice level 1,050 - 1,100 Plan level	0 Notices 1,500 - 1,900 Plans	530 - 1,070 Plans	0 Notices 2,080 - 1,970 Plans
Underground Mines (20yrs.)	120 Notices 150 Plans	120 - 130 Notice level 150 - 160 Plan level	0 Notices 220 - 250 Plans	210 - 230 Plans	0 Notices 240 - 270 Plans
Industrial Mines (20yrs.)	240 Notices 60 Plans	240 - 250 Notice level 60 - 70 Plan level	0 Notices 250 - 280 Plans	235 - 270 Plans	0 Notices 270 - 290 Plans
Mill Site Operations (20yrs.)	480 Notices 120 Plans	480 - 500 Notice level 120 - 130 Plan level	0 Notices 490 - 550 Plans	430 - 480 Plans	0 Notices 540 - 580 Plans
Notices and Plans / year	600 Notices 150 Plans	600 - 630 Operations < 5 ac. 150 - 160 Operations > 5 ac.	302 - 340 Notices 290 - 330 Plans	0 Notices 480 - 580 Plans	360 - 380 Notices 340 - 360 Plans
Acres Disturbed / yr.	8,700	8,700 - 9,200	6,700 - 7,580	4,800 - 6,440	8,120 - 9,630
HAZARDOUS MATERIALS AND WASTE MANAGEMENT					
Mine Waste	Mine waste might not be reclaimed properly and could cause contamination.	Same as Alternative 1, but BLM might not be aware of mine waste left on site.	Mine waste could be reclaimed to control potential contamination.	Mine waste (certain types of pond sludge, lab wastes, etc.) would be removed from public lands.	Same as Alternative 1.

109

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
			CLIMATE AND AIR QUALITY		
Climate and Air Quality	No impacts to climate. Impacts to air quality would continue at current levels. Direct impacts include noise; dust; gaseous and particulate emissions; exhaust from blasting, extracting, crushing, milling, and hauling. Most impacts would exist only during life of operations. All operations would continue to comply with all air quality laws, standards, and implementation plans.	Similar to Alternative 1. A cumulative increase in overall emissions could result from a 5% increase in mining. All operations would continue to comply with local, state, tribal, and federal air quality laws, standards, and implementa-tion plans.	Similar to Alternative 1. A cumulative decrease in overall emissions could result from a 15% decrease in mineral activity. All operations would continue to comply with local, state, tribal, and federal air quality laws, standards, and implementation plans.	Similar to Alternative 1. A cumulative decrease in overall emissions could result in up to a 20% decrease in acreage disturbed and a 30% decrease in open pit mining. All opera-tions would continue to comply with local, state, tribal, and federal air quality laws, standards, and implementation plans.	Similar to Alternative 1. A cumulative decrease in overall emissions could result from up to a 10% decrease in mining. All operations would continue to comply with local, state, tribal, and federal air quality laws, standards, and implementation plans.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
			WATER RESOURCES		
Water Quality	Mining deeper into the sulfide ore zone could result in water quality problems with pit lakes and migration of contaminants into aquifers. Potential acid rock drainage and leachate might enter surface or ground water. Tailings and process pond runoff or leakage could enter surface water and cause heavy metals contamination. Character of local aquifer could change due to physical removal and replacement of geologic material in backfilling.	Variable, depending on state program.	Reduced risk of degraded groundwater quality through backfilling, grouting of exploration holes, and use of source controls for handling acid-forming materials. Improved requirements for baseline data collection and increased ground water monitoring programs would provide early detection and mitigation of potential impacts.	Alternative 4 has the lowest potential for water quality impacts of all alternatives. Pit lake impacts on water quality would decline due to pit backfilling and requirement that pit lakes not exceed acute toxicity standards. Design controls would reduce the risk of contamination from leaks or facility failures. Decreased mining activity would reduce the potential for impacts to water quality.	Provides for improved water quality protection by establishing pit water quality conditions suitable for the long-term use of the site and affected ground and surface waters. Planning for long-term closure or treatment would help mitigate or avoid later problems.
Water Quantity	Dewatering could cause some streams and springs to dry up and increase streamflow in other streams, altering stream morphology and character. Some streams might be diverted from channels and rerouted.	Same as Alternative 1.	Dewatering effects would continue about the same as under Alternative 1.	Dewatering effects would be similar to Alternatives 1 and 3, but possibly reduced with fewer operations.	Dewatering effects would be similar to Alternatives 1 and 3.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
			SOILS		
Acres/Year Soil Disturbed	8,700	8,700 to 9,260	6,700 to 7,580	4,800 to 6,440	8,120 to 9,630
Soil Salvage and Reclamation Availability	Soil salvage limited to topsoil. Reclaimed surface may not support the same plants or diversity as before disturbance.	Same as Alternative 1.	Soil salvage limited to topsoil or replacement soil. Reclaimed surface may not support the same plants or diversity as before disturbance, but better overall plant production expected.	Soil salvage includes topsoil and subsoil. Reclaimed surface should support the plants and diversity similar to the preexisting plant community.	Same as Alternative 1.
Post-Reclamation Erosion Control and Soil Loss Potential	Stability requirement would generally limit soil loss. Emphasis on revegetation would reduce erosion.	Same as Alternative 1.	Stability requirement would generally limit soil loss. Greater emphasis on revegetation would reduce erosion.	Regrading to 3h:1v slopes and increased revegetation requirements would reduce soil loss.	Same as Alternative 1.
			VEGETATION		
Acres /Year Vegetation Disturbed	8,700	8,700 to 9,260	6,700 to 7,580	4,800 to 6,440	8,120 to 9,630
Reclamation Timing and Diversity-Density	Quick reestablishing of vegetation cover (except in Alaska), long-term increase in diversity, and use of native species.	Same as Alternative 1.	Quick reestablishing of vegetation cover would result in more timely reestablishing of a diverse native cover.	Would ensure establishing of native cover to at least 90% of adjacent undisturbed lands within 10 years.	Same as Alternative 1.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
VEGETATION (continued)					
Noxious Weed Infestation of Disturbance	Long-term improvement in weed control as policies are implemented.	Lack of comprehensive effort to control weeds would likely result in increased infestations.	Greater emphasis on weed control would reduce infestations.	Mandatory weed control would reduce or eliminate weed infestations.	Same as Alternative 1.
RIPARIAN-WETLAND RESOURCES					
Mitigation/ Replacement and Protection	Nature, duration, and extent of riparian-wetland disturbance would continue as in past. Mitigation not required for BLM-defined riparian-wetland habitat but generally conducted with fish and wildlife rehabilitation. Mitigation usually consists of creating new areas. Replacement areas would not restore lost function for many years. Mitigation would also not address problems of temporal or spacial loss of function.	Nature of riparian-wetland disturbance would be similar to Alternative 1. Impacts to riparian-wetland areas meeting BLM criteria would likely not be mitigated unless state has specific requirement to do so.	Lost or degraded riparian-wetland areas would be reclaimed or mitigated to achieve proper functioning condition (PFC). BLM would set recovery time for PFC. In the long term no more riparian-wetland habitat or function would be lost. Mitigation would not address problems of temporal or spacial loss of function. BLM's ability to require detailed baseline information for riparian-wetlands could help increase success rate of mitigation through improved design. The substantial irreparable harm standard would protect significant wetland and riparian areas.	The nature of unavoidable disturbance would be similar to that under Alternative 3. The time requirement to meet PFC, the greater restoration: disturbance mitigation required, and ability to require baseline data would offset the uncertain nature of mitigation and loss of temporal and spacial function. The requirement to prevent irreparable harm would protect wetland and riparian areas from loss of productivity. Bonding would cover the cost of actions taken to correct degradation of riparian-wetland areas from unplanned events.	Riparian-wetland areas would receive slightly more protection than under Alternative 1 due to the more stringent performance standard. Nonjurisdictional wetlands would not be protected, and restoring riparian areas to PFC would not be required by regulation.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
AQUATIC RESOURCES					
Habitat Protection and Rehabilitation	The removal of riparian vegetation would result in long-term loss of aquatic habitat: 25 to 50+ years, or until riparian-wetland areas reestablish to PFC. Aquatic communities could be displaced by increased streamflow during dewatering and deficient flows after dewatering. Increased sedimentation and turbidity expected over the long term. Runoff and seepage of contaminates during perpetual treatment could threaten aquatic life. Suction dredging could degrade aquatic habitat and cause increased mortality of juvenile fish.	Nature, duration, and extent of impacts to aquatic habitat and communities would be similar to those under Alternative 1. States might require that aquatic habitat be restored to premining condition. In some states (e.g. California) suction dredging impacts to aquatic habitat and communities would be reduced or avoided because of specific state permit requirements.	The requirement to minimize disturbance to aquatic resources would slightly lessen habitat impacts. Habitat disturbance would be similar to that under Alternatives 1 and 2. The duration of disturbance might be slightly less because of BLM's ability to set the time frame for riparian-wetland recovery. Impacts of suction dredging would be reduced. The ability to require detailed baseline environmental information should increase rehabilitation success.	Impacts would be similar to those under Alternative 3. Duration and extent of impacts could be greatly reduced by the required 10 year time frame for habitat restoration. Offsite riparian-wetland mitigation at a ratio of 1.5 to 1 would help offset the temporal and spacial functional loss of riparian-wetlands. Runoff, seepage of contaminants would not as greatly threaten aquatic life because BLM could designate some acid-producing deposits as unsuitable for mining. Bonding would cover actions needed to mitigate impacts from unplanned events providing a safeguard against long-term impacts.	Aquatic resources would receive similar protection as under Alternative 1. Requiring Notice-level bonding would help ensure rehabilitation but would not protect resources from unplanned events.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
AQUATIC RESOURCES (continued)					
Protecting Fish and Invertebrate Populations	Fish and invertebrates, including sensitive species, would continue to be displaced, injured, and killed. The level of impact would vary by state and specific site.	Impacts to fish, including sensitive species, would be similar to Alternative 1.	Protection of common and sensitive fish species would be increased compared to Alternative 1. BLM could prevent operations that would cause substantial harm to significant aquatic resources.	Protection similar or greater than under Alternative 3.	Protection of common and sensitive fish species would be similar to that under Alternative 1.
WILDLIFE AND THREATENED AND ENDANGERED SPECIES					
Protecting Wildlife Resources	Wildlife protection would be similar to the levels reported during the past 10 years, but new mining and reclamation technologies and the strengthening of related regulations and policies would better protect wildlife over time.	Overall, protection of wildlife would decrease slightly as a result of differing state regulatory requirements and lack of BLM review.	Better protection of wildlife would contribute to the maintenance of wildlife populations at present levels and maintenance or enhancement of habitat through improved and careful planning and more specific reclamation standards.	Offers most protection of wildlife of all alternatives because the reclamation standards are the most stringent and specific time frames would be set for reclamation. These provisions would promote the conserving or reestablishing of a viable, diverse habitat in a timely manner, thus reducing the time that habitat would be unsuitable for species.	Similar to Alternative 1, but wildlife habitat would receive increased protection through the Plans of Operations required for all mining activity.
WILD HORSES AND BURROS					
Wild Horses and Burros	Impacts would be similar under all alternatives and proportional to the amount of mineral activity. Herds could be displaced by noise, vehicle traffic, human presence, or loss of forage or water sources. Water sources could be lost by restricted access or dewatering. Sensitivity would be most acute during spring foaling.				

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	**Alternative 1: Existing Regulations (No Action)**	**Alternative 2: State Management**	**Alternative 3: Proposed Regulations (Preferred Alternative)**	**Alternative 4: Maximum Protection**	**Alternative 5 NRC Recommendations**
LIVESTOCK GRAZING					
Livestock Grazing	Impacts would be small under all alternatives. Mining has affected an estimated 0.1% of animal unit months since 1981. Mining displaces livestock grazing by disturbing forage, water sources, or other range developments. Impacts could be mitigated; otherwise, the level of grazing would have to be reduced on the grazing permit or lease. After reclamation some grazing might be reestablished.				
SPECIAL STATUS AREAS					
Types of Designated Special Status Areas in 3809 Regulations	Lands in the California Desert Conservation Area (CDCA), National Wild and Scenic River System, areas of critical environmental concern (ACECs), designated wilderness, and areas closed to off-road vehicle (ORV) use.	Would not provide special protection to special status areas.	Requiring Plans for all mining and milling and expanding special status lands would improve protection of unique or valuable resources in national monuments, national conservation areas and critical habitat for threatened or endangered species.	Since Alternative 4 requires Plans for all but negligible disturbance, it gives all lands special status area protection in this respect.	Same as Alternative 1.
Protection Level	Plans and bond required for any activity. Activity within CDCA, Wild and Scenic River System, and wilderness areas would have to meet stated levels of resource protection or reclamation required by statutes.	Mining within CDCA, Wild and Scenic River System and in wilderness areas would continue to have to meet the levels of resource protection or reclamation required by statutes establishing these areas. ACECs and areas closed to ORVs would be protected as provided for by state regulatory programs.	Same as Alternative 1, except land use plans and the requirement to prevent substantial irreparable harm would protect special status areas that do not have stated levels of resource protection or reclamation required by statute.	Suitability requirements and the requirement to prevent irreparable harm would protect resources for which special status areas were designated. Requirement for American Indian concurrence for activity in areas designated as valuable for traditional cultural resources would protect those areas and resources.	Same as Alternative 1. In addition, the requirement to file a Plan of Operations instead of a Notice for any mining would afford increased protection to resources in areas that were not added to the special status category.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
RECREATION					
Recreational Mining	No change from present.	Similar to Alternative 1.	Slight decline in participation.	Decline in participation.	No change from present.
Other Recreation Users	Mix of recreational opportunities would change. Primitive recreation opportunities would continue to decrease, while opportunities for more developed recreation would increase.	Similar to Alternative 1, but proportionately greater decrease in primitive recreation opportunities and increase in developed recreation would result from 5% overall increase in mining.	Similar to Alternative 1, but proportionately smaller decrease in primitive recreation opportunities and increase in developed recreation from 5% overall decrease in mining.	Similar to Alternative 1, but greater potential for preserving recreation opportunities at the primitive end of the spectrum would result from potential 30% decrease in mining. Developed recreation opportunities created by mining and increased access would be forgone.	Similar to Alternative 3.
VISUAL RESOURCES					
Visual Quality	No change from current conditions. In some locations severe visual effects would result.	Effects to visual quality would be greater than under Alternative 1 because of less emphasis on scenic quality and small increase in activity.	Effects to visual quality would be much less severe than under No Action because of greater emphasis on visual resources and lower level of mineral activity.	Similar to Alternative 3 but less impact to visual resources due to pit backfilling requirement.	Similar to Alternative 1.
VRM Compliance	Some projects would not meet VRM objectives.	VRM guidelines would not apply.	Projects would not be likely to meet VRM objectives.	Most projects would meet VRM objectives.	Some projects would not meet VRM objectives.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
PALEONTOLOGICAL RESOURCES					
Paleontological Sites	Low impacts from Notice-level activity. Plan-level activity would benefit paleontological sites due to discovery and inventory of previously unknown sites	Without BLM project review a net loss of site information would result.	Requirements for inventories and mitigation development before surface disturbance would reduce or possibly prevent most potential impacts. Increased recovery time would benefit paleontological resources in cases of incidental discovery.	Same as Alternative 3. Eliminating Notices and unrestricted data recovery time would virtually eliminate adverse impacts and might benefit acquisition of paleontological data.	Requiring Plans for all activities except casual use and exploration would reduce impacts of Notice-level activities.
CAVE RESOURCES					
Cave Sites	Notices, Plans, and current mining would have more indirect than direct impacts to caves.	Loss of cave resources from both Notice- and Plan-level activity.	Some reduction in impacts because of reduced activity and added inventory and mitigation requirements for cave resources.	Greatest reduction in impacts because of moderate reduction in mineral activity and requirement that all disturbance above casual use undergo environmental review.	Requiring Plans for all activities except casual use and exploration would reduce impacts of Notice-level activities.

Table 2-3. 2000 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
CULTURAL RESOURCES					
Historic Properties (Non-Traditional Cultural Properties)	3% of Notices would affect historic properties due to limited advance review of Notice-level activities. Plan-level operations would not affect historic properties due to advanced inventory, consultation, and mitigation.	Increased impacts to cultural resources without BLM review, consultation, or mitigation.	Increased time frame for site recovery would reduce impacts to incidental discoveries.	Eliminating Notices would virtually eliminate impacts to historic properties because of advance inventory, consultation, and mitigation, including operations on split-estate lands.	Requiring Plans for all activities except casual use and exploration would reduce impacts of Notice-level activities.
Traditional Cultural Properties (TCPs)	Impacts would continue from Plan- and Notice-level operations. Some impacts would continue due to large size of most traditional cultural properties, making avoidance impractical as mitigation.	With increases in mining, impacts from Notice- and Plan-level activity would increase. Without BLM's inventory, consultation, and mitigation, impacts would increase.	Impacts would decrease because of a slight decrease in mineral activity and greater proportion of Plans requiring inventory, consultation with American Indians, and opportunity for mitigation. The new definition of unnecessary or undue degradation would also reduce impacts.	Decreased activity would greatly reduce potential for impacts. Eliminating Notices would greatly reduce impacts by requiring advanced inventory, consultation, and mitigation. Some residual impacts could still result because of the large size of some traditional cultural properties, making avoidance impractical as mitigation.	Similar to Alternative 1. Requiring Plans for all mining would reduce impacts of Notice-level activities.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
AMERICAN INDIAN RESOURCE CONCERNS					
Trust Resources	Potential for impacts from Notice-level operations would continue.	Potential for impacts would increase without BLM review of activity that might affect trust resources.	Requiring Plans for all mining would reduce impacts of present Notice-level activities. Probable reduction in impacts due to decrease in activity and increased proportion of mining activity requiring consultation.	Reduction or elimination of impacts due to moderate decrease in activity and removal of Notice provision, therefore requiring consultation on all activity greater than casual use that might affect trust resources.	Requiring Plans for all mining would reduce impacts of present Notice-level activities.
Traditional Cultural Practices and Resources	Some residual impacts could not be mitigated and would continue.	Increased impacts expected from lack of mandated consultation or mitigation development.	Requiring Plans for all mining would reduce impacts of present Notice-level activities. Moderate decrease in impacts due to reduction in mineral activity, increased amount of consultation and mitigation, and requirement to prevent substantial irreparable harm to significant cultural resources.	Substantial decrease in impacts due to moderate reduction in activity and required concurrence by American Indians before allowing disturbance of lands with traditional cultural resources.	Requiring Plans for all mining would reduce impacts of present Notice-level activities.
Subsistence Resources	Potential for impacts from Notice-level operations would continue. ANILCA would prevent impacts from Plan-level activity.	Increased potential for impacts from increased activity and lack of BLM reviews or approvals of mineral activity.	Requiring Plans for all mining would reduce impacts of present Notice-level activities.	Impacts from Notice-level operations would be eliminated. ANILCA would prevent impacts from Plan-level activity.	Requiring Plans for all activities except casual use and exploration would reduce impacts of Notice-level activities.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative

Affected Resource or Activity	Alternative 1: Existing Regulations (No Action)	Alternative 2: State Management	Alternative 3: Proposed Regulations (Preferred Alternative)	Alternative 4: Maximum Protection	Alternative 5 NRC Recommendations
			SOCIAL CONDITIONS		
Small Miners	No effect.	No effect.	Potential for minor to major effects if alternative employment must be found due to greater restrictions on small operations.	Potential for major effects. Plan requirements difficult for most small operators. Major effect if alternative employment must be found.	Potential for minor effects due to potential for a slight decline in mineral activity. Major effects if alternative employment must be found due to greater restrictions on small operations.
Communities	No effect.	Potential for minor benefits to mining-dependent communities due to slight increase in overall mining.	Potential for minor to significant adverse effect to mining-dependent communities including declines in social well-being due to potential for up to a 30% decrease in some types of mining.	Potential for significant adverse effect to mining-dependent communities, including declines in social well-being due to potential for up to 75% decrease in some types of mining.	Potential for minor negative effects to mining-dependent communities due to potential for a slight decline in mineral activity.
Environmental Advocacy Groups	Would not favor. Not enough resource protection.	Would oppose this Alternative.	Would favor this alternative.	Would favor this alternative.	Would not favor this alternative.
General Public	Inconsistent with attitudes of increasing numbers of people that resources should be better protected.	Same as Alternative 1.	Consistent with attitudes of increasing numbers of people that resources should be better protected.	Consistent with attitudes that resources should be better protected but some might feel it goes too far to protect resources over commodity use.	Consistent with attitudes that resources should be better protected, but some might feel it doesn't go far enough to protect resources.

Table 2-3. 3809 Regulations Summary of Impacts by Alternative					
Affected Resource or Activity	**Alternative 1: Existing Regulations (No Action)**	**Alternative 2: State Management**	**Alternative 3: Proposed Regulations (Preferred Alternative)**	**Alternative 4: Maximum Protection**	**Alternative 5 NRC Recommendations**
			ECONOMIC CONDITIONS		
Total Annual Mineral Production Value	$1.7 billion	$1.7 to $1.78 billion (up to +5% across study area)	$1.21 to $1.53 billion (-10% to -28% across study area)	$532 to $925 million (-45% to -69% across study area)	$1.6 to $1.69 billion (-1% to -6% across study area)
Total Annual Employment	21,310 jobs	21,310 to 22,380 jobs	19,200 to 15,240 jobs	6,670 to 11,610 jobs	20,050 to 21,160 jobs
Total Annual Personal Income	$1.39 billion	$1.39 to $1.46 billion	$994 million to $1.25 billion	$435 to $758 million	$1.31 to $1.38 billion
Total Annual Industry Output*	$3.08 billion	$3.08 to $3.23 billion	$2.20 to $2.77 billion	$963 million to $1.68 billion	$2.99 to $3.06 billion
Local Economies	No impact.	Positive impacts mainly from increased level of local mining. Impact would depend on a variety of factors: level of activity now occurring, degree of community's specialization in mining, and community size.	Negative impacts mainly from decreased level of local mining. Impact would depend on a variety of factors, including the level of activity now occurring, degree of community's specialization in mining, and community size.	Negative impacts similar to Alternative 3, but many more communities are likely to be affected. Degree of impact would depend on a variety of factors: level of activity now occurring, degree of community's specialization in mining, and community size. Communities in Nevada would see greatest impact relative to other states.	Negative impacts similar to Alternative 3 but not as great.
*Includes multiplier effect of mining industry expenditures.					

Chapter 3
Affected Environment and Environmental Consequences

Introduction

Chapter 3 describes the physical, biological, social, and economic environment and the potential effects on the human environment of the Proposed Action and other alternatives described in Chapter 2. This format eliminates the redundancy created when the affected environment and the environmental consequences are discussed in separate chapters. Chapter 3 is organized by resource, allowing the reader to better review and understand the existing situation and the potential environment impacts of all the alternatives by resource.

Except for BLM-administered lands that are under wilderness review, the proposed regulations apply to all operations authorized by the mining laws on public lands administered by BLM, including Stock Raising Homestead lands where the mineral interest is reserved to the United States. Mineral activity on BLM-administered lands under wilderness review are subject to the requirements at 43 CFR 3802. In addition, public lands open to mineral entry under the mining laws but not administered by BLM (national park, national forest, and national wildlife refuge lands) are not covered by the proposed regulations. Mineral disturbances on these lands are regulated by the relevant federal land managing agency, i.e. National Park Service, U.S. Forest Service, and U.S. Fish and Wildlife Service.

Most public lands open to activities under the mining laws are in the 11 contiguous western states, plus Alaska. (See Table 3-1.) Within the study area, BLM administers a surface and mineral estate of about 260 million acres. In addition to this surface/mineral estate, BLM also administers 300 million more acres of mineral estate underlying other lands. The surface of 70 million acres of these mineral estate lands were patented under the Stock Raising Homestead Act. By statute these patents had the mineral estate retained by the Federal Government and kept the lands open to mineral entry under the mining laws.

The study area accounts for about half of the total acreage within the United States, but 99% of all public lands administered by BLM are within the 12-state study area. BLM-administered public land acreage as a percentage of the total acreage within each state within the study area ranges from less than 1% in Washington to more than 68% in Nevada. In addition, 95% of the lands patented under the Stock Raising Homestead Act, where the mineral estate was retained by the Federal Government, are also within the study area. Almost half of these split-estate lands are located in New Mexico and Wyoming.

Table 3-1. Distribution of BLM-Administered Public Land, Stock Raising Homestead Act Acreage, and Total State Acreage

States	Public Land Acreage[1]	SRHA Acreage	Total State Acreage
Western U.S.:			
Alaska	86,526,170	0	365,481,600
Arizona	14,225,888	2,985,746	72,699,000
California	14,565,597	3,423,222	100,206,720
Colorado	8,328,739	8,405,015	66,485,760
Idaho	11,789,324	3,563,294	52,933,120
Montana	6,225,205	7,720,173	93,271,040
Nevada	47,883,408	494,637	70,264,320
New Mexico	13,149,476	15,621,192	77,766,400
Oregon	16,143,043	3,375,688	61,598,720
Utah	22,769,356	2,800,709	52,696,960
Washington	386,334	513,746	42,693,760
Wyoming	18,356,977	18,172,713	62,343,040
Total Study Area	260,349,517	67,076,135	1,118,440,440
Other States:[2]	1,531,061	3,286,790	1,152,902,920
U.S. Total	261,880,578	70,362,925	2,271,343,360
Study Area as Percent of U.S.	99%	95%	49%

[1] Includes all public lands administered by BLM except for Land Utilization Project lands, to which the 3809 regulations do not apply. Also includes lands that are withdrawn from mineral entry.
[2] Includes Alabama, Arkansas, Florida, Illinois, Iowa, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, N. Dakota, Oklahoma, S. Dakota, and Wisconsin.
Source: BLM 2000a, 1979.

Public lands in the 12-state study area have a wide range of climates, landforms, vegetation types, and social and economic settings. Physical characteristics such as climate and soil types and biological parameters such as vegetation productivity and the presence of special status species differ markedly. The physical and biological attributes described in this chapter highlight these differences only where needed to describe the affected environment in relation to the regulatory alternatives.

The Proposed Action and alternatives analyzed in this chapter consist of potential changes in the regulations that are set forth to prevent unnecessary or undue degradation of public lands by operations authorized under the mining laws. Environmental consequences that would result from these potential regulatory changes can be categorized and presented in many ways. Some impacts are the direct effect of implementing the action, whereas others are more indirect, occurring later or further away. The impacts may last for only a short time or may affect the environment for a long period. The environmental consequences may be adverse, beneficial, or both. Many of the potential regulatory changes would be largely administrative and would have little direct effect on the environment. These administrative changes are aimed at improving agency efficiency and effectiveness, increasing consistency, or meeting other nonenvironmental objectives or public policies.

The administrative changes would, however, result in indirect or secondary effects on physical, biological, social, or economic aspects of the environment. Chapter 3 discusses all aspects of the environmental consequences of the Proposed Action and other alternatives. But the environmental impacts of future on-the-ground disturbances, requiring National

Environmental Policy Act compliance, will be analyzed on a case-by-case basis.

As this EIS was prepared to evaluate the environmental consequences of regulation alternatives, it was not practical to document the affected environment or environmental consequences at the level of detail generally found in site-specific EISs. The regulatory alternatives will affect the nature, extent, and environmental consequences of future mineral activity on public lands administered by BLM. The uncertainties of where, when, and how this future mining will occur make accurate long-term forecasts impossible and even short-term projections tenuous. But to aid in the analysis, reasonably foreseeable assumptions on future activity were prepared (Appendix E). These assumptions became the basis for much of the environmental consequences discussed in this chapter. The approach used to document the reasonably foreseeable significant effects conforms to the requirements at 40 CFR 1502.22 when dealing with situations where information is incomplete or unavailable. Approval of future mineral activity, subject to National Environmental Policy Act, will be documented and analyzed at a level of detail commensurate with the proposed on-the-ground disturbance.

Assumptions for Analysis

The analysis of the environmental effects of the Proposed Action and alternatives is based on the following assumptions.

Full Implementation. To clearly give a scientific and analytic basis for comparing the regulatory alternatives, we assume full implementation of each regulatory alternative. This assumption allows us to more sharply define the environmental consequences of the regulatory options to aid in decision making. Full implementation requires adequate agency funding and staffing to ensure that all the provisions of the proposed regulations and alternatives are fully implemented.

No Action Alternative. The No Action Alternative (Alternative 1) assumes that the existing regulations continue unchanged. Although it assumes no change in the existing regulations, this alternative still may have environmental consequences. Future mineral activity under the No Action Alternative is presented as a set of assumptions. These assumptions are fairly general, given the diversity of mining on public lands, variety of mining and exploration methods, commodities extracted, geographic scope, and inherent uncertainty of the commodities markets. These assumptions concerning the future under the No Action Alternative are discussed in Appendix E.

Changes in Mineral Activity. Estimates of mineral activity for Alternatives 2, 3, 4, and 5 are presented as changes from the baseline (No Action Alternative). As with the assumptions for future mineral activity, it is neither practical nor even possible to develop complete information on future changes in mineral activity resulting from the implementing of regulatory alternatives. Appendix E discusses the approach used to document the reasonably foreseeable significant effects. This approach conforms to the requirements at 40 CFR Part 1502.22 for situations where information is incomplete or unavailable. The changes in mineral activity estimates are intended to help evaluate the environmental consequences of the proposed regulations and alternatives, specifically to give the public and decision makers information on the potential direction and magnitude of change. These estimates of the expected changes in mineral activity should not be considered factual data or accurate or precise estimates of change. Because of the uncertainties in forecasting and the many comments received on the estimates presented in the draft EIS, the team opted to present the estimates of changes in mineral activity as ranges.

Past, Present, and Future Actions and Events. The cumulative effects of past actions and events are reflected in the Affected Environment. These past actions and events include existing legal requirements and past and present public land uses and land use decisions.

The existing legal federal requirements that are relevant to mineral exploration and mining are discussed in Appendix C. Appendix D presents a summary of the key state mining regulations. Where recent actions and events have taken place, we discuss the potential consequences to the affected environment. We note pending or future actions and events but do not attempt to speculate on the potential effects of these actions.

Discretionary Regulatory Provisions. Many of the provisions in the proposed regulations give BLM discretion on how, when, and where to implement the provision. Two provisions in the proposed regulations are of particular importance because of the potential magnitude of the impact on the industry and the environment. The backfilling requirement in the proposed regulations provides that *BLM will determine the amount of pit backfilling required, if any, taking into consideration economic, environmental, and safety factors. In addition, the proposed definition of unnecessary or undue degradation has been expanded to include preventing* ***...conditions, activities, or practices that...*** *result in substantial irreparable harm to significant scientific, cultural, or environmental resource values of the public lands that cannot be effectively mitigated.*

The proposed backfilling provision is similar to the existing State of Nevada requirements. A recent BLM study of the pit backfilling in Nevada reported that no major mine pits have been completely backfilled (BLM 1998d). About 25% of recently approved Plan-level operations with pits have been or are proposed to be partially backfilled. As such, for our analysis we assume that pit backfilling will generally be limited to situations that allow for concurrent pit reclamation, such as operations with multiple pits.

The proposed addition of the substantial irreparable harm to the unnecessary or undue degradation definition would apply to all operations under the proposed regulations, including casual use and Notice- and Plans-level operations. BLM will need to consider this provision when it approves or reviews a proposed action. The Preamble for the proposed regulations states that the intent is for this provision to be used to deny a Plan of Operations or reject a Notice only in exceptional circumstances. In addition, Section 3809.411(d)(3)(iii) provides that if BLM disapproves a Plan of Operations on the basis of this provision, it must include written findings supported by a record that clearly shows each element of the provision. The proposed regulations require that any decision to deny a Plan of Operations be based on this provision. Any decision to deny a Plan of Operations must be supported by documentation showing how the following four criteria have been met.

- Approval of the Plan of Operations would create irreparable harm.
- The irreparable harm is substantial in extent, duration, or magnitude.
- The resources undergoing substantial irreparable harm constitute significant scientific, cultural, or environmental resources.
- Mitigation would not be effective in reducing the level of harm below the substantial or irreparable threshold.

Consistent with this intent, we assume that BLM would rarely deny a Plan of Operations or reject a Notice on the basis of this substantial irreparable harm provision for most resources. But we also recognize that the determination of what constitutes substantial irreparable harm, significant resources, and effective mitigation is not always straightforward to BLM or the public. Of specific concern are activities that will potentially affect Native American sacred or religious values. One can argue that religious significance, substantial irreparable harm, and effective mitigation are determined by those that hold those beliefs, not by BLM. Analyzing the implementing and impact of this provision as it applies to sacred and religious values is further complicated by the fact that most the Native American religions are based on or incorporate the concept that each individual determines what is significant for herself/himself. Because of these concerns, we assume that this provision as it relates to sacred and religious values will be extensively applied.

Cumulative Effects

The regulations for implementing the National Environmental Policy Act (NEPA) require federal agencies to analyze and disclose *cumulative* effects—effects that result from the incremental impact of an action "when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7)

The Proposed Action and alternatives involve changes in the regulations and as such are broad in scope. As a result, this EIS is programmatic, addressing environmental consequences that are correspondingly broad in scope. Furthermore, neither the Proposed Action nor the alternatives would be implemented in a vacuum. Implementation would be interwoven with many other actions, events, and trends taking place at local, regional, national, and international levels. For example, actions on federally administered lands may have beneficial or harmful impacts to systems on private lands. The analysis in this chapter strives to consider these changes.

For example, mineral activity is not the only factor that affects the public lands. Climate, recreation, livestock grazing and wildlife use, management practices on adjoining lands, and the introduction and spread of alien weeds are also key considerations. The future of the public lands cannot be predicted by considering changes in mineral activity and the 3809 regulations alone. Similarly, BLM regulations, management practices, and policies are not the only factors that affect the mining industry and western rural communities. Of major importance are currently undiscovered mineral deposits; local, national, and international supply and demand for mineral commodities; regional population growth; changing demographics, lifestyles, and values; economic competition and restructuring; and changing laws, policies, and practices being implemented by other federal and state agencies.

Population growth and demographic changes in the West and in many western rural communities will continue to transform rural economies. Population growth in many rural communities, while contributing to economic growth and diversification, will continue to diminish the relative importance of mining in those communities. Communities that continue to lose population and whose economies are in decline may be further strained by any decrease in mineral activity. Demographic and land use changes might increase or decrease a community's tax base. Where economies are stable or growing, the tax base would likely be stable. Where populations continue to decline or mineral production significantly declines, the state and local tax revenues might decline.

The protection and recovery of federally listed species and their habitats—for example, desert tortoises in the desert Southwest—are also likely to change the way mining activity is conducted on federal lands. Future activities designed to avert habitat loss and endangered species listings will be implemented under any of the regulatory alternatives considered in this EIS.

A fundamental assumption of this analysis is that, with or without changes to the 3809 regulations, the human environment within the study area will continue to change. The 3809 regulations are but one small factor in defining the future conditions of the human environment. The potential environmental consequences of the proposed action and alternatives, including the cumulative effects, are documented by resource in this chapter.

Irreversible and Irretrievable Commitment of Resources

A resource is irreversibly committed when an action alters the resource so that it cannot be restored or returned to its original or predisturbance condition. A resource is irretrievably committed when a resource is removed or consumed.

For example, in the extraction of gold, the mining of waste rock and ore would be an irreversible commitment of resources. Although the gold in ore would be irreversibly committed from geologic formations, the precious metal would be retrieved and placed in long- term economic circulation.

Another example of irreversible losses involves soil erosion. Soil losses from handling, erosion losses from topsoil stockpiles, and other unavoidable erosion losses would be irreversible. The net evaporative losses of water from a pit lake would be an example of a long-term irretrievable commitment of resources. Consumptive use of process water would be an example of a temporary irretrievable commitment of resources, occurring only during mining.

The level of future mineral activity under the Proposed Action or alternatives would directly affect the magnitude of the irreversible and irretrievable commitment of resources. But provisions of the alternatives would also define the nature and extent of these commitments. These types of irreversible and irretrievable effects are discussed as part of the environmental consequences of the alternatives for each resource in this chapter.

Environmental Justice

Federal agencies are required to address "disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low- income populations" (Executive Order 12898). During this analysis BLM considered all public input from persons or groups, regardless of age, race, income status, or other social and economic characteristics.

This document is a broad assessment of proposed regulations. Environmental Justice issues are meant to be addressed at the local level. As CEQ's Environmental Justice Guidance under the National Environmental Policy Act states, "Agencies should recognize that the question of whether agency action raises environmental justice issues is highly sensitive to the history or circumstances of a particular community or population, the particular type of environmental or human health impact, and the nature of the proposed action itself."

Mineral Resource Development

Affected Environment

Geology

The public lands have a rich geologic history and an abundance of mineral resources. The geology on public lands is highly complex and difficult to summarize. The regions have been subdivided into geologic physiographic provinces such as the Basin and Range, Colorado Plateau, Snake River Plain, Rocky Mountain, and the Columbia Plateau, to name a few. The public lands includes geologic formations dating from the Archean (early part of Precambrian era) to the Quaternary period.

Gold is extensively produced in Nevada, copper in Arizona, placer gold in Alaska, and gypsum in California. Minerals extracted from the public land include copper, gold, silver, lead, mercury, uranium, perlite, bentonite, and limestone. The potential for continued mineral production on public lands is high, and the mineral industry continues to develop these lands for a variety of mineral products.

Understanding ore deposits is a complex and difficult task. But basic understanding of ore deposits is needed to understand the complex nature of the mining types and their impacts . The following passage is reprinted with permission from Appendix A of the National Research Council (NRC) study *Hardrock Mining on Federal Lands* (NRC 1999).

> Ore deposits form as variants of such geologic processes as volcanism, weathering, and sedimentation operating with an extraordinary intensity. Ore deposits typically are parts of large-scale (several miles across and perhaps just as deep) ore-forming systems in which many elements, not just those of economic interest, have been enriched. For example, arsenic, antimony, thallium, and mercury are commonly enriched in or near Carlin-type gold deposits. Explorationists continually seek to discern trace chemical haloes or geophysical patterns to combine with geological observations and concepts to recognize faint clues to the location of the ore deposit. Known ores constitute less than one part in 10,000 of the metal endowment of the upper 1 km of continental crust; thus, by far the largest portion of metals resides in ordinary rocks as a low-level background geochemical signature in amounts to meager for economic mining.
>
> Many hardrock commodities are associated with magmatic and hydrothermal processes (Guilbert and Park, 1986). These processes, in turn, are associated with modern or ancient mountain belts. Mountainous or sparsely vegetated terrains, such as those in the western states, expose possibly productive rocks much more fully than do, for example, mid-continent prairies. In addition, the West is blessed with geologic conditions, including abundant igneous rocks and associated hydrothermal systems, that have led to the formation of ore deposits. Thus, the prime prospecting ground is in land that many people regard as valuable for aesthetic reasons, which creates potential for conflict among uses of the land.

Development of Mineral Properties

To understand how the 3809 regulations apply to mineral activities on public lands, one should review the steps or phases used to locate and develop mineral properties. The following is a description of the process the mining industry uses to develop mineral properties and the types of mining methods used to extract minerals.

All mining operations begin with exploration activities that require large dollar investments coupled with a high risk of failure. Success of mining depends on the success of exploration. Exploration may discover a mineral occurrence and may even outline its size and mineral character. The ore deposit is "found" or "developed" only through the combined efforts of the many geologists, geophysicists, geochemists, metallurgists, mining engineers, lawyers, and managers who believe that a mine can be profitably developed. Deposits go through many cycles of evaluation and rejection. Before they are brought into production, geologic understanding improves, and worldwide economic and political conditions change. The location of a mining claim or group of claims follows the prospecting or exploration program and is essential to the next phase of developing a mineral deposit into a mine.

The development of a mine from grassroots exploration to production can be roughly divided into three stages. Each stage requires applying more discriminating (and expensive) techniques over successively smaller areas to find, develop, and produce economic mineral deposits. These stages can be grouped into the following activity categories: reconnaissance, exploration/prospecting, and mine development.

The lag time between the first discovery of a mineral occurrence and the opening of a mine may be 10 years or more. Some gold properties are opened within 3 years, whereas copper deposits may require more than 10 years. During this time operators do the following:

- Analyze all available and reasonable geologic information.
- Make engineering decisions for the design of the mine.
- Acquire equipment and workers.
- Prepare mine closure and reclamation plans.
- Obtain financial capital.

Reconnaissance. The first phase of exploration involves researching the geologic literature; reviewing the geologic models for the minerals of interest; and interviewing local, knowledgeable, experienced people and companies working in the area of interest. Once reconnaissance has found a favorable area, usually occupying tens of square miles, it may use airborne and satellite remote sensing surveys and limited ground surveys to examine the general characteristics of the area's geology and mineralization and then select smaller targets of interest for more detailed study. Such study may involve detailed surface geologic mapping, geophysical surveying, and geochemical sampling programs, none of which disturb the land's surface. Academic and government entities or major corporations usually carry out these studies.

Reconnaissance-level mineral inventories normally cause no more surface disturbance than an occasional sampling of soil, rocks, or stream sediment. These inventories may require minor off-road vehicle use. To protect its interests, the company will begin staking and recording mining claims. These actions do not disturb the surface or require surface reclamation and would be considered casual use.

Prospecting and Exploration. Americans generally use the terms prospecting and exploration interchangeably. Prospecting normally denotes activities of a single person, whereas a company engages in exploration using a variety of techniques to evaluate both the surface and subsurface geologic characteristics of a mineral occurrence (Hartman 1992).

When a sufficiently anomalous mineral occurrence or favorable occurrence indicator is found, a mineral prospect is established and is subjected to more intense evaluation through exploration. This area may range from a single square mile to an entire mountain range of several hundred square miles.

Mineral exploration has had many cyclic developments in the last half century. Early efforts concentrated on comparing new areas with existing mines and mineralization. The introduction of airborne and satellite remote sensing, computer models, and a better understanding of geologic processes led to the discovery of porphyry copper deposits, Mississippi Valley lead- zinc deposits, and volcano genic massive sulfide deposits. In the past 15 years exploration has mainly targeted disseminated gold and stratiform precious metal deposits. In the future major exploration targets will focus on the following:

- World-class deposits of all kinds of minerals.
- Small high-grade deposits with low capital costs that will be profitable under any market condition.
- Polymetallic deposits that can be mined by surface methods (Hartman 1992).

Efforts to locate a mineral prospect include detailed mapping, sampling, and geochemical and geophysical study programs. At this time the mining company usually begins to acquire property, and most mining claims are located to secure ground while trying to make a mineral discovery. Surface-disturbing activities in prospecting involve more intense soil and rock chip sampling using mostly hand tools, frequent off-road vehicle use, and the placing and maintaining mining claim monuments. This activity is normally considered "casual use" (43 CFR 3809.1-2) and does not require BLM notification or approval. Operations under casual use require no mechanized equipment or explosives but must reclaim disturbed areas.

Exploration involves prospecting at a more intense level and in a smaller area. In addition, roads are built, trenches dug, and exploration holes drilled. In later stages of exploration an exploratory adit or shaft may be driven. If the prospect already has underground workings, these may be sampled, drilled, or extended.

Subsurface exploration by shafts and large-diameter (more than 18 inches) drill holes are normally used for finding mineral targets or the development phase of mining and not initial exploration.

Exploration may involve mechanized earth moving equipment and drill rigs and explosives. A typical exploration project requires building about 5,000 feet of access road, setting up a dozen drill sites with each site having several holes drilled to less than 500 feet, and possibly digging several trenches 200 feet long by 8 feet wide by 6 to 8 feet deep. The number of pits and trenches depends on the expected size of the mineralized area as determined by surface mapping and sampling. Test pits are usually less than 20 feet deep and 10 feet in diameter. Trenches are normally less than 10 feet wide, 20 feet deep, and 100 feet long. The area for a drill rig is about 50 feet square. Most surface disturbed for exploration amounts to less than 5 acres. Exploration is normally conducted under a Notice in the existing 3809 regulations, which require the operator to notify BLM 15 days before beginning activity. If exploration is conducted in sensitive areas or exceeds the 5-acre threshold, an approved Plan of Operations is required.

Mine Development. If exploration results show that an economically viable mineral deposit is present, on-the-ground activity will intensify to obtain detailed knowledge on reserves, possible mining methods, and mineral processing requirements. This effort will involve more intensely applying all the previously used exploration tools. After acquiring enough information, the operator will conduct a feasibility study to decide whether to proceed with mine development and what mining and ore processing methods to use.

When an operator decides to develop a property, the mine permitting process begins. Once BLM approves the Plan of Operations, work begins on developing the mine infrastructure:

- Building the mill, offices, and laboratory.
- Driving development workings for an underground mine or prestripping for an open pit mine.
- Building access roads or haulage routes.
- Placing utility services.

During this development, exploration continues in order to define other areas to be mined.

Mine development involves the following activities: mining, ore processing, tailings disposal, waste rock placement, solution processing, and metal refining. Such activities require the use of

- Heavy earth moving equipment.
- Explosives for mining.
- Materials handling.
- Exploration equipment for refining the ore reserve base.
- Hazardous or dangerous reagents for processing requirements.
- General construction.

Once enough facilities are in place, mine production begins. Often concurrent with production are "satellite" exploration efforts to expand the mine's reserve base and extend the project life. Upon completion of or concurrent with mining the property is reclaimed.

The sizes of mines vary greatly. Not all mines require all the previously mentioned facilities and equipment. Acreages involved can range from several single acres to several hundred acres. Most projects disturb more than 5 acres and require an approved Plan of Operations.

Mining Methods

The impact of mining and the effects of regulations on the mining industry depend on the mining methods used and the mineral deposits mined. Mining methods have been classified to help select extraction methods for deposit types and for other factors. In addition, this classification helps evaluate the impacts of the chosen method. Mineral deposits have been geometrically described by an idealized shape, inclination, size, and depth. Complex or composite bodies consist of more than a single deposit type (Hartman 1992).

The ideal shapes are either tabular or massive with narrow bodies or pipes being subordinate. Tabular bodies of minerals usually extend hundreds of feet horizontally and only a few tens of feet vertically. Ore from tabular bodies is generally extracted by strip mining, of which placer mining is a subcategory. Massive ore bodies are approximately equip-dimensional (laid out for easy equipment use) and are usually a few hundred feet in each dimension. Ore from massive bodies is generally extracted by open pit mining (Hartman 1992).

In surface mining the horizontal angle of the deposit (usually a bedded deposit with overburden less than 100 feet thick) and the deposit's relative width determine whether the minerals are mined by strip or pit methods. For example, flat-lying deposits are opened up by making narrow mining cuts into the deposit and then casting or hauling the next cut's waste into the previously mined area. Placer mining methods are used for deposits that are under water or have a large amount of ground water because of the need to handle large amounts of water. For deposits lying at a steeper angle or with thick overburden, open pit methods are used. The stability of the unmined rock determines the pit's depth.

Strip Mining. Strip mines have the following characteristics:

- Usually designed for rectangular tabular deposits that are longer than they are wide.
- Found in areas of rugged topography where the deposit may be bisected by narrow gullies.
- Located where the overburden is relatively shallow (low stripping ratios) and the deposit itself is not at a great depth below the land surface.
- Used where the deposit is interbedded between uneconomic rock units or located in topographic low areas (valleys).

In strip mining the topsoil and overburden are removed from the ore deposit and stockpiled separately, usually a short distance from the initial mine cut. The deposit is mined in a linear fashion until the end of the ore deposit or the property limits are reached. A second identical pass is then made next to the first except that the overburden is placed into the previous mined out area. After the third cut is made, the original stockpiled overburden is graded into and over the first two cuts. Topsoil is then respread over the site, and vegetation is reestablished. The remaining deposit is mined in a similar fashion until the deposit is exhausted. The strip mine is reclaimed at the same time that ore is mined, except for the last one or two mine cuts, which are reclaimed after the mine is closed.

In strip mining little more area is disturbed for waste rock or tailings dumps because these materials are returned to the mined area as soon as there is space. Access roads, mill and office buildings, and water treatment facilities usually occupy the only other areas needed for this type of mining.

Placer Mining. Suction or mechanical dredge mining techniques are commonly employed to extract minerals lying in loosely consolidated deposits with large amounts of ground water or in rivers or lakes. Intake nozzles for suction dredges vary from 2 to 10 inches in diameter. The most common sizes range from 4 to 6 inches. Generally the processing system is relatively simple with a grizzly (screen) separating off the oversized rocks. Screens classify the smaller material and a sluice box, with regular or modified iron angle-iron riffles, concentrates the valuable minerals. The recovery system is usually supported on floats above the intake nozzle in the pond that is created when excavating the overburden. A gasoline-powered high-pressure water pump supplies water to the intake for suction to extract the mineral-bearing material from the pay streaks or bedrock areas.

In the past, mechanical bucket-line dredges were used to mine deeply buried placer minerals. These dredges moved great amounts of material while floating in a pond created by the excavation of the barren gravels. Material was excavated and processed on and tailings were disposed from the floating platform. The moving chain of buckets excavated the gravel. Gravels were emptied into revolving screen classifiers, which separated the undersized material from the oversized. The oversized material was transported by conveyors behind and away from the dredge.

The processing plant for the recovery of the gold consisted of either jigs or sluice boxes onboard the dredge. Most of these dredges are no longer operating on public lands. Smaller cutter-head dredges can be used. But because of high mechanical wear and many breakdowns, other mining methods are more commonly used to mine alluvial deposits.

Placer deposits are mined either by strip or pit methods with the addition of water control structures such as bypasses or drains to dewater the gravel deposits. Once the water has either been removed or reduced to an amount manageable through the use of pumps, the topsoil is removed and saved for future respreading over the mined areas. The overburden is removed and stockpiled or placed in previously excavated areas as part of the reclamation sequence of the mine. The mineral-bearing gravels are hauled to the processing or washplant, where gravity separation methods are used to recover valuable minerals in the sluice box or jig unit. The washed gravels are placed in the previously mined areas, usually on top or intermixed with the overburden. The tailings are then reshaped, covered with the original topsoil, and reseeded to prevent erosion and finish the reclamation of the mined site.

Open Pit Mining. Open pit mines have the following characteristics:

- Usually designed for massive or steeply inclined (dipping) deposits.
- Dimensional or narrow in extent and size.
- Found in areas of rugged topography.
- Located where the overburden is relatively thick (high stripping ratios).
- Located where the deposit is relatively deep below the land surface.
- Used where the deposit is interbedded between uneconomic rock units or where the rock strength is weak and not suitable for underground methods.

The topsoil and overburden are removed from the ore deposit, and the deposit is mined in a downward fashion until the limits of the deposit are reached. The limits of the mine pit are not solely related to the grade of the ore but also to the engineering of the pit slopes and the economics of removing overburden and ore from the pit.

The stockpiled overburden is placed in valleys near the mine site or on the surface of adjacent land and then graded into a stable shape. The waste rock from the mill is deposited in large settling ponds or may be placed on the surface of the land and reshaped. Ponds are located where they are most cost effective and the topography is most stable. The land beneath the ponds and waste piles is permanently lost to any other uses. Topsoil is placed over the overburden or waste piles and the pond areas when they are reclaimed, and vegetation is established at the sites.

Reclamation is generally not concurrent with mining and is not usually begun until the mine is closed. If the mine is deep, the cut is generally not filled. In open pit mining other areas are disturbed for waste rock and tailings dumps, access roads, mill and office buildings, and water treatment facilities.

Underground Mining. Underground mining generally involves the removal of the mineralized vein or lode from the surrounding country rock. Minable widths vary from less than 4 feet to more than 20 feet. Ore is usually extracted from highly competent rock or rock that is reinforced with bolts or anchors so that surface subsidence is negligible. Massive block caving techniques may create localized subsidence of the surface. The mined-out underground workings are usually backfilled with the waste rock from mining or the mill tailings. Backfilling maintains the competency of the surrounding rock and prevents subsidence.

In all underground mining some of the waste must be placed on the surface temporarily or until there are enough underground openings to hold the replaced waste rock. Some waste rock may be placed on the surface permanently because there is not enough room to replace the waste or the mining method is not amenable to replacing the waste.

Most surface impacts from underground mining involve mining-related surface uses such as milling, office functions, storage, waste and tailings disposal, and water treatment. All of these activities are similar if not the same as the surface-disturbing activities of surface mines and mill sites.

In Situ Mining. A mining method that is considered neither surface nor underground is "in situ" extraction of valuable minerals by remobilizing or leaching minerals where they occur. This method drills holes on a grid pattern into the ore deposit. A dissolving or leaching solution is then injected through these holes into the ore deposit, where the chemicals extract the desired minerals. The pregnant liquid is then removed from a different well or series of wells and piped to a recovery plant or mill. There the minerals are recovered and the barren solution returned to the injection wells and the cycle begins again. In situ mining appears to be more like a milling operation and less like most extraction methods. Except for the access roads and pipelines leading to the recovery facility, the surface is only slightly disturbed.

Mill Sites and Tailings Sites. Mill and tailings sites are usually found with one of the other types of mining methods, depending on the characteristics of the ore. At mills, minerals can be extracted either by chemical or physical methods. Mill sites can also be established apart from any specific mine and operate as a small custom mill for small operators.

Storage facilities and mills for processing mined rock and treating tailings have traditionally been placed on areas that have no mineral value. These sites may be next to the mine or removed some distance from the mine site.

Mill sites are used for locating offices, warehouses, repair shops, crushing and grinding systems, chemical and physical separation and concentration systems, leach pads, and other facilities that support the mine. Mill processing plants may be as simple as a sluice box next to a water source and the alluvial material trucked to the site. Or they may consist of a group of structures, each housing a part of the processing machinery that recovers the commodities in a series of steps. Milling of certain ores ranges from simple gravity and water washing systems to chemical and flotation treatments to mechanical crushing and sorting processes that form the finished product. Mill facilities may cover an area from less than 1 acre to 10 or more acres.

Since the 1980s tailings impoundments have become a small part of the mill site operations, as more mines used cyanide heap leaching techniques to recover the minerals and only small treatment and concentration buildings are needed for mills. Some heap leach pads are massive–2,000 feet wide by 2 miles long–and are in continuous use for up to 5 years.

Tailings disposal is a major if not sole purpose of some mill site claims. Tailings is the general term for all waste rock and processed rock that remains on the surface after the valuable minerals have been extracted. Some waste rock is barren of mineralization and may cause no problems being left on the surface after reshaping and the establishing of vegetation cover. But other waste rock has minerals with the potential to generate acid or alkaline leachate and may affect the environment for many years.

Tailings have undergone physical and in some cases chemical changes and may have been ground so fine that they are more susceptible to erosion or chemical changes than in their original state. Or residual traces of treatment chemicals may be trapped in the rock. In general, tailings and waste areas occupy about 10% of the total area disturbed by mining.

Mill sites may require either a Notice or a Plan of Operations, depending on whether they are in designated special status areas or if they exceed 5 acres.

Types of Operators

A wide variety of mineral exploration and extraction occur on public land. Operations range from the lone prospector to corporate-driven enterprises. Operators have varied range of financing, expertise, resources, and abilities to develop mineral deposits. On the average all types of mineral operators have strong land stewardship and understand the need for a good environment.

The lone prospector is working on locating that mother lode deposit that they can sell or lease to bigger operation to continue exploration or development of the mine. Small independent geologist and exploration companies are also trying to locate and define potential ore deposits that they can sell to even larger operations in order to develop. These types of operations are stacking capital, time, and labor into these projects in the hopes that in selling them they make a profit.

Mining also has small operators. These operators consist of small families who work mining operations and whose wages consist of profits above the capital costs from their operations. Small operators work in the belief that time will make their efforts highly profitable.

In addition, some people explore and mine for the enjoyment of the activity. These people and groups are engaging in a recreational past time. Developing minerals and earning profits from the activity are only secondary to the activity itself.

And there are some operators whose intent is not to develop minerals. They derive their profits from investments received from others. They develop operations and sell shares of it, hoping to make a profit on the operations. Though few, these operations do occur on public lands.

Operations backed by corporate resources has extensive abilities to explore and develop mineral properties. These companies usually have strong environmental policies and the ability to accomplish the needed tasks. Their overriding goal, however, is to make a profit.

Past Activity Under the 43 CFR 3809 Regulations

BLM issued the 3809 regulations in 1981. The following information on past mining on the public lands was developed from *Public Land Statistics* (BLM various years) and internal BLM surveys.

Between 1981 and 1997 a total of 20,700 Notices and 3,400 Plans of Operations were submitted to BLM. An average of 1,200 Notices and 200 Plans of Operations have been submitted each year. But the number of operations has been decreasing over the last several years. In 1999 BLM received 155 Plans and 640 Notices. As of 1997, a total of 6,216 Notices and 932 Plans of Operations were considered active (see Tables 3-2 and 3-3), meaning that operations under the Notices or Plans were ongoing. The remainder had been reclaimed, and BLM had determined that they were closed. A total of 177 and 155 Plans of Operations and 588 and 640 Notices were submitted in 1998 and 1999 respectively according to *Public Land Statistics* (BLM 1999a, 2000a). The number of operations that have closed in the past 2 years is unavailable.

Table 3-2. Notice-Level Activity

Type of Activity	Submitted Since 1981		Closed Since 1981		Currently Active	
	# Notices	Acres	# Notices	Acres	# Notices	Acres
Exploration	13,653	27,463	9,767	18,433	3,915	9,555
Strip Mining	257	738	155	460	102	278
Open Pit	999	2,071	453	1,022	556	1,048
Placer	5,012	12,133	3,382	8,670	1,317	3,472
Independent Mill Site	135	402	65	193	66	200
Underground	644	1,101	386	678	260	436
Total	20,700	43,908	14,208	12,866	6,216	14,989

Table 3-3. Plan-Level Activity

Type of Activity	Submitted Since 1981		Closed Since 1981		Currently Active	
	# Plans	Acres	# Plans	Acres	# Plans	Acres
Exploration	1,302	18,742	1,032	5,415	269	13,422
Strip Mining	87	13,123	66	8,332	22	4,790
Open Pit	591	117,166	261	14,563	330	101,564
Placer	1,288	7,993	949	6,269	232	1,724
Independent Mill Site	52	6,281	18	104	33	6,182
Underground	85	6,514	39	399	46	6,115
Total	3,405	169,819	2,365	35,082	932	133,797

Tables 3-4 and 3-5 show the distribution of current mineral activity by state and the types of activity currently occurring on public lands in the study area.

Table 3-4. Percentage Distriubtion of 1997 Notices and Plans by Type of Activity

Type of Operation	Notices	Plans
Exploration	63	29
Strip Mining	2	2
Open Pit Mining	9	35
Placer Mining	21	25
Underground Mining	4	4
Independent Mill Site	1	5
Total	100%	100%

Table 3-5. Total 1997 Plans and Notices in Study Area

State	Total Notices	% of Total Notices	Total Plans	% of Total Plans
Alaska	153	2	47	5
Arizona	909	15	96	10
California	1,009	16	290	31
Colorado	264	4	23	2
Idaho	135	2	35	4
Montana	300	5	27	3
Nevada	2408	39	277	30
New Mexico	68	1	6	1
Oregon/WA	386	6	38	4
Utah	410	7	39	4
Wyoming	174	3	54	6
Total	6,216	100	932	100

The surface disturbance varies for each type of operation from an average of 300 acres of disturbance for open pit mines to 7.4 acres for placer mines. Disturbance for Notice-level exploration operations ranges from 0.5 to 4 acres. Tables 3-2 and 3-3 show the estimated average number of acres disturbed by Notice- and Plan-level operations on public lands. The Notices and Plans closed means that reclamation has been completed and accepted by BLM. Current active operation may have the operation and reclamation completed but are still waiting for final reclamation clearance.

Table 3-6 shows the number of notices of noncompliance that have been issued on public lands and the reasons they were issued.

Table 3-6. Notices of Noncompliance

Type of Activity	Notice-Level Operations		Plan-Level Operations	
	# Issued Since 1981	# Currently Outstanding	# Issued Since 1981	# Currently Outstanding
Exploration	394	138	79	14
Strip Mining	7	0	4	2
Open Pit Mining	88	9	66	10
Placer Mining	145	24	70	9
Independent Mill Site	26	6	26	8
Underground Mining	40	4	13	3
TOTAL	690	181	258	46

Currently Outstanding Notices of Noncompliance

Reason for Issuance	Notice Level	Plan Level
Failure to File a Notice or Plan	13%	19%
Issued During Operational Phase of Project	15%	35%
Failure to Reclaim	72%	46%
Total	100%	100%

BLM issues notices of noncompliance only when operators fail to correct or discuss concerns. BLM will work with operators during compliance inspections and meetings before issuing notices of noncompliance. Under the current policy BLM will meet or inform the operator of a concern and work with the operator to remedy the concern to both BLM and the operator's satisfaction. Only when the operator refuses to address the concern with BLM do the noncompliance procedures begin with the issuing of a notice of noncompliance.

The existing regulations call for three levels or procedures for incidents of noncompliance. At the first level, BLM issues a notice of noncompliance requiring operators to correct problems by a certain date. At the second level, if operators do not correct the noncompliance, BLM issues a record of noncompliance, and operators must post bond for their entire operations at 100% of reclamation costs. And at the third level, if operators take no further action, BLM sends their cases to the U.S. Attorney's Office to be resolved. Of the total incidents of noncompliance 76% have been resolved by notices of noncompliance, 15% by records of noncompliance, and 9% by the U.S. Attorney.

Historically, the number of noncompliance issues have been small, amounting to about 4%, of the number of Notices and Plans submitted. These noncompliance issues have involved unnecessary or undue degradation to public lands, mainly reclamation not being completed. Conditions in these unreclaimed areas have degraded public lands and to various degrees are continuing to degrade public lands.

Of the 254 active notices of noncompliance, 208 are for Notice-level operations, and 46 are for Plan-level operations. BLM has issued notices of noncompliance to 3% of Notice-level operations and 4% of Plan-level operations; 73% of all notices of noncompliance issued have been resolved.

Environmental Consequences

Impacts Common to All Alternatives

Under all alternatives compliance with environmental regulations represents a cost to the mining industry and affects the level of mineral exploration and mining. Included are the following costs:

- Costs of delays resulting from longer processing times.
- Direct costs of conducting environmental studies.
- Costs of having to use certain technology.

Delays could result from an operation's not being able to mobilize on schedule because of weather and other restrictions. Delays could mean that a deposit would not be developed, production would not begin on schedule, and the operation would lose revenue. Environmental standards also increase the cost of doing business.

These regulations and the expanding regulatory environment have had a cumulative effect on the mining industry's cost of doing business. The new state and federal regulations are requiring more time and monitoring from the operator to meet these new requirements. These types of activities relate to operations in cost. These costs range from less than 1% of the total cost of the operations to as high as 20% of the overall operating budget. These cost vary greatly depending on an operation's site-specific resource concerns.

The mining industry will continue to experience increased regulations and restrictions from state and federal agencies. Mandates such as the toxic release inventory will continue to require more reporting and monitoring of operations. Several sweeping regulatory changes to the Clean Water Act

(CWA) programs are pending, and proposed and final test method changes show the breadth of changes to the CWA programs. The Departments of the Interior, Agriculture, Commerce, Defense, and Energy; the Environmental Protection Agency; the Tennessee Valley Authority; and the Army Corps of Engineers have also just developed a federal lands policy drafted to purportedly enhance implementing the Clean Water Act and the Administration's Clean Water Action Plan. Land use restrictions from zoning and mineral withdrawals will continue to restrict access to areas for mineral development. The changing agency policies, responding to environmental degradation, political pressures, and court cases, will change how the mining industry operates on public lands.

Alternative 1: No Action

Administration of Surface Management Regulations. Under the No Action Alternative the mining industry would continue to operate under the existing 3809 regulations and would continue to assimilate the cost of the regulations. Operations would continue to be processed, and compliance would be completed. These regulations would result in no added cost to industry.

Casual Use. Casual use should only negligibly disturb the environment. But major problems could arise when groups get together to recreate, explore for minerals, or placer mine for gold. Under these situations the cumulative impacts could exceed negligible levels, resources would be damaged, and the disturbance would generally not be reclaimed.

For example, several dozen to more than 100 people equipped with shovels and gold pans in a small area or section of stream can denude the vegetation, compact the soil, and result in a loss of deeper rooted vegetation. This disturbance could lead to streambank destabilization, resulting in a series of channel adjustments over a broader area. Such changes in turn this could lead to the loss of riparian areas.

Notices. The existing regulations for Notices would require BLM to process actions in a short time period and allow operators to continue operations without delay. An interdisciplinary team would review Notices, but the review would be limited to 15 days. In some situations the review specialist could not review the document, and the project would proceed without this specialist's input. Under these conditions resource damage could result.

A Notice could be used to operate in an environmentally sensitive area because the existing regulations list only a few areas that are environmentally sensitive and thus require a Plan of Operations. Any operations that are in sensitive areas but do not require Plans of Operations would increase the potential for degradation without the intense review provided for Plans.

Notice provisions could be difficult to enforce because no reclamation bond is required for Notice-level activity. The lack of a bond and enforcement process could result in areas not being reclaimed when operators leave, although this is not a common practice. BLM issued about 500 notices of noncompliance (out of about 29,400 Notices filed since 1981) for failure to reclaim, representing 2% of all Notices submitted.

Plans of Operations. Under No Action, BLM would continue to review in detail Plans of Operations, and these Plans would undergo environmental review under the National Environmental Policy Act (NEPA). NEPA's analysis would allow for a more detailed review of operations and would ensure against unnecessary or undue degradation.

Policy would require reclamation bonding for all chemical processing areas, but only a portion of the reclamation cost would be bonded for other facilities. BLM field offices might not uniformly implement bonds and other performance measures that BLM has developed by policy and experience.

The current gold prices have affected the industry, and mining companies are going into bankruptcy and increasing BLM workloads. Workloads have increased as BLM tries to use the bond monies available and to acquire public monies to clean up these operations. On the basis of past bonding practices, the bond amounts are not adequate to completely reclaim the operations. In Nevada alone, 29 operations are in bankruptcy.

Inspection and Enforcement. The existing regulations make timely resolving of noncompliance difficult and do not outline the need for consistent review of operations. As a result, BLM might not inspect operations in a timely manner, and resource degradation could result.

Under the current process if an operation is in noncompliance, BLM would need more time for coordination with the operator and other organizations to resolve the noncompliance. If the operation does not conform to the Plan or Notice, BLM would issue a notice of noncompliance and request compliance within a certain time. If the operator still does not comply, the operation's file would be sent to the BLM state office for transmittal to the U.S. Attorney's Office. Because of the U.S. Attorney's workload and priorities, years could pass before the case could be settled and the environmental problem corrected.

If the operation is abandoned and the case is not settled in the courts, there might be no bond to reclaim the operation and resolve all environmental concerns. The site would either not be reclaimed, or public monies would be used to reclaim it. In 1999 BLM surveyed its field offices, asking them to list all operations under the existing 3809 regulations that had been abandoned by their operators, and where BLM had spent, or was likely going to have to spend, funds to reclaim the land. The combined field office response listed some 530 such operations. The actual number of abandonments is even greater since not all abandoned operations will require remediation. Most of these are abandoned Notice-level operations. The amount of public monies needed to reclaim these sites is unknown at this time.

Table 3-7. Acres Disturbed under Alternative 1

	Acres Disturbed		
	Per Operation	Per Year	In 20 Years
Notice Level	2 acres	1,200	24,000
Plan Level	50 acres	7,500	150,000

Data from the recent past suggests that if the current rate of noncompliance persists, within the next 20 years BLM would issue 360 notices of noncompliance for Notice-level activity and 120 for Plan-level activity.

Administrative Practices. Under the existing regulations, mines proposed either for areas withdrawn from mineral entry or for extracting suspected common variety minerals under the Mineral Materials Act of 1947 and the 1955 Surface Resources Act would be processed under a Notice or a Plan of Operations. The operator would not have to demonstrate a valid claim before disturbing the surface. Potential environmental harm could result, and the Federal Government could lose revenue.

Mineral Development. The overall number of Notices and Plans of Operations submitted under No Action is expected to decrease to the current 3-year trend and remain constant or decrease slightly. This trend is based on the existing regulations and the current regulatory environment for operations on public lands. Individual states might vary from the general trend in the number of Notices and Plans submitted. For this analysis, 600 Notices and 150 Plans of Operations would be submitted each year. Over a 20-year period 12,000 Notices and 3,000 Plans of Operations would be submitted. Table 3-7 shows the acreage that would be disturbed per operation and total acres that would be disturbed in 20 years under the No Action Alternative.

Table 3-8 shows the possible number of operations at the Notice and Plan levels by operation type during the next 20 years.

Table 3-8. Notice- and Plan-Level Operations over a 20-Year Period under Alternative 1

Type of Operation	Notices	Plans
Exploration	7,560	870
Placer Mining	2,520	750
Strip Mining	240	60
Open Pit Mining	1,080	1,050
Underground Mining	120	150
Mill Site	480	120
Total	12,000	3,000

Exploration. Exploration activities would continue to be processed on the basis of the type of operation and the amount of surface disturbance. There would continue to be a short turnaround for operations working under Notices, and the industry should incur no more cost. Small independent geologists and prospectors would continue to pursue mineral deposits as allowed under the existing regulations. Most small operations and individuals mining for recreation would be considered casual use.

Mining. Mining operations would continue under the existing regulations and policies, which include the cyanide management and acid rock drainage policies. Future policies could be developed to define environmental protection requirements under the existing regulations.

Alternative 2: State Management

Administration of Surface Management Regulations. State mining regulations are relatively new and still evolving. The main regulatory provisions in most cases are less than 8 years old, and many are newer (McElfish and others 1996). State programs are based either on requiring reclamation or preventing water pollution (or both). (See Appendix D.)

Casual Use. Under the State Management Alternative state government would not review proposed mineral activities classified as casual use. Depending on the state requirements and minimum surface disturbance criteria, the mineral activity might not be reviewed. States would not require casual use operations to complete reclamation, and public lands could undergo unnecessary or undue degradation. BLM would have difficulty directly preventing degradation except through negotiations with state organizations.

Notices. For Notice-level operations, depending on state requirements, operators may not be required to submit any documentation for review by a state organization. In some states, operations smaller than 5 acres are not required to be reclaimed. Such operations would still be required to meet state environmental protection and performance standards.

Plans of Operations. Under State Management, depending on state criteria for surface disturbance or production, operations would be required to submit some form of a Plan of Operations to a state regulatory agency. The operation would have to meet performance standards and requirements of the state in which it is operating. Western states have environmental regulations that require some of the reviews outlined in BLM's existing regulations. Some states would require environmental reviews. Others would not. Operations would have to comply with water regulations and standards and monitoring outlined by the states. Bonding would also be required. Depending on the state program, bond monies may or may not be sufficient to reclaim the operations.

Inspection and Enforcement. Operations would have to undergo compliance inspections, but depending on the state organizations, standards or schedules might not be established. BLM would not issue notices of noncompliance under Alternative 2 and would not take be directly involved in enforcement actions. States would continue to enforce their own programs. (See Appendix D.)

Mineral Development. According to the mineral activity projections in Appendix E, the overall range of change under State Management would be from a 0% to 5% increase in exploration and mining activity. (See Appendix E.) These changes, by activity type, are shown in Table 3- 9.

Table 3-9. Changes in Mineral Activity under Alternative 2

Casual Use/ Suction Dredging	Small Exploration	Large Exploration	Small Placer	Large Placer	Small Open Pit	Large Open Pit	Small Under-ground	Large Under-ground	Industrial Minerals
0 to +5%	0 to +5%	0 to +5%	0 to +5%	0 to +5%	0 to +5%	0 to +5%	0 to +5%	0 to +5%	0 to +5%

Table 3-10 outlines the possible number of operations by type under the State Management Alternative for the next 20 years.

Table 3-10. Number of Operations under Alternative 2 over a 20-Year Period

Type of Operation	<5 Acres		>5 Acres	
Exploration	7,560	7,940	870	910
Placer	2,520	2,650	750	790
Strip	240	250	60	70
Open Pit	1,080	1,130	1,050	1,100
Underground	120	130	150	160
Mill Site	480	500	120	130
Total	12,000	12,600	3,000	3,160

Under these assumptions, on the high end, 630 operations would disturb less than 5 acres a year, and 160 operations that would disturb more than 5 acres a year. Over a 20-year period, from 12,000 to 12,600 operations would disturb less than 5 acres each, and from 3,000 to 3,160 operations would disturb more than 5 acres each. Table 3-11 shows estimated acreage that would be disturbed under Alternative 2.

Table 3-11. Acres Disturbed under Alternative 2

	Acres Disturbed				
	Per Operation	Per Year (0-5%)		In 20 Years (0-5%)	
Notice Level	2	1,200	1,260	24,000	25,200
Plan Level	50	7,500	8,000	150,000	158,000

Exploration. Depending on a state's regulations, potential exploration would increase because operations may not have to submit notifications to either BLM or some state agencies. The higher end of the range would be in states that do not require notification or the operator to spend extra capital and operational cost to cover exploration permitting. The smaller exploration companies, independent geologists, and prospectors could earn more profits in future property sales. The percentage of increase would depend on the state regulations that would need to be followed. Operations at the lower end of the range would be regulated by states with more restrictive regulations. Operations of all sizes should see a decrease in permitting costs.

Mining. The range of change would be small for mines operating in states that have mining and reclamation regulations. The major change would be the amount of environmental work required from each state. Mines in states requiring environmental analysis documents similar to EAs and EISs, and plans with bonds would not experience any change. States not requiring environmental documents would see an increase in mining in response to a decrease in the cost of exploration in these areas. Operations of all sizes would see some decrease in the amount of permitting required to open a mine.

Alternative 3: Proposed Action

Administration of Surface Management Regulations. The proposed regulations would increase costs to the mining industry.

Casual Use. Casual use would continue to consist of operations that cause negligible disturbance. People and organizations that are now conducting operations as casual use would continue to engage in exploration and mining for recreation and mineral development but could not cause surface disturbance above the definition of casual use without a Notice or Plan. The resulting decrease in cumulative impacts of casual use would improve environmental protection.

BLM would be able to determine if many operations whose cumulative effects are causing degradation beyond casual use would require a Notice or a Plan of Operations. Preparing Plans or Notices would delay activities and affect small recreational activities. In responding to the submittal of Plans and Notices and providing timely response to recreational activities, BLM's workload would increase.

Notices. Under the Proposed Action exploration involving less than 5 acres could operated occur under a Notice. Any mining in special category lands would require Plans of Operations. Under Notices, operators would be subject to performance standards that would minimize impacts to ensure against unnecessary or undue surface degradation. These standards would require the operator to design activities and take more time in developing operations. More time by BLM and the operator would be required to address the performance standards and determine the site-specific needs for the projects. This would increase costs for industry and the workload for BLM.

The Proposed Action would require bonding for Notice-level operations. Reviewing and accepting a bond would require more work for BLM but would provide a way to enforce reclamation and mitigation. The cost of obtaining a bond, where one was not previously required, would be a considerable added expense to exploration operators.

Plans of Operations. Plans of Operations would be expanded to include all types and sizes of mining operations. Exploration projects that disturb more than 5 acres or are in special category areas would also require Plans of Operations. BLM's workload would increase with all mining operations being required to submit Plans of Operations.

BLM workload would increase with the need to review or coordinate several activities before approving a Plan. These activities would includes a 30-day public comment period in conjunction with the environmental analysis and consultation with other interested parties and agencies.

Environmental performance standards under the Proposed Action are similar to current BLM polices and guidelines in various states. BLM has developed policies on certain issues, such as cyanide management, through experience in working with the mining industry and the public. BLM has also applied its understanding of what actions or data are needed to prevent unnecessary or undue degradation. The Proposed Action has incorporated these policy standards into the regulations. No other impacts to industry or natural resources are expected from these standards other than greater consistency among BLM offices.

Plans of Operations would require bonding for 100% of the estimated reclamation cost, increasing workloads by requiring BLM to review in more detail the reclamation plan and cost estimating. Bonding would result in a more a complete interdisciplinary review of the reclamation plan and assure the reclamation of disturbed land if the operator cannot meet their reclamation responsibilities. Mining companies would face more delays in starting or modifying their projects. Funds for reclamation in the event of operator bankruptcy should be adequate to reclaim the operations.

BLM might disapprove a plan if it does not meet the requirements of the regulations, the exploration or mining site lies within an area withdrawn from mineral entry, or the activity would result in unnecessary or undue degradation. This would be a significant impact on the operator and mineral resource development.

Inspection and Enforcement. The Proposed Action would require a mandatory number of inspections for certain types of operations. The specific inspection frequency is already included in BLM policies and is not expected to increase BLM workloads.

Enforcement provisions of the Proposed Action would include the use of suspension orders and discretionary penalties, which BLM could assign for noncompliance. These orders and penalties would slightly increase the workload to develop the case and defend the orders and penalties. But BLM would have greater legal recourse to use against operators who refuse to comply.

Under the Proposed Action during a 20-year period 200 to 180 notices of noncompliance and suspension orders could be expected for Notice-level activity, and 260 to 230 could be expected for Plan-level activity.

Administration Practices. The Proposed Action would change the regulations to include Stock Raising Homestead Act lands whose surface is privately owned but whose mineral estate has been retained by the Federal Government. These new regulations would allow access to those lands for mineral resources but would apply only if the land owner and the mineral operator cannot agree on the development of the minerals. BLM's workload would increase with the development of Plans of Operations, but the number of Plans that would be submitted is uncertain. BLM's workload, however, would increase under all alternatives because recent amendments to the Stock Raising Homestead Act mandate BLM's involvement whenever the surface owner does not consent to mineral development.

The Proposed Action would require a mineral validity exam for any operation in an area under mineral withdrawal. Before BLM can allow operations to start, the exam must show that the operator has the right under the Mining Law to disturb surface resources. By not being allowed to begin operations until the exam has been completed, an operator could lose revenue due to time delays. Conversely, if the operator does not have the right to develop the minerals, then the environmental resources would be protected. BLM's workload would increase because of the exam requirement. The validity exam is an extensive process that BLM-certified mineral examiners can complete.

Under the Proposed Action, if a mineral is suspected of being of common variety, the operator might receive an interim authorization until a validity exam is conducted with a common variety determination. During the interim authorization, operators could continue to sample their site and conduct yearly assessment work to meet Mining Law requirements and hold their claims. Or they could develop an escrow account in a form acceptable to BLM.

Developing an escrow account and depositing the fair market value of the material mined would allow operators to continue mining until the common variety determination has been completed.If the mineral is determined to be uncommon, the money would be refunded to the operator, who could proceed under the Mining Law. If the mineral is determined to be common and salable under 43 CFR 3600, the money would be paid to the U.S. Treasury.

These regulations would increase BLM's workload by requiring BLM to review the proposals and determine if impacts have been minimized. BLM would also have to review operations to ensure that they have met the standards outlined in the regulations and determine if the impacts would be at the lowest practicable level. Under its current funding and staffing levels, BLM's increased workload would delay projects, and BLM might not be able to meet the 30 working day response time for Plans of Operations.

Mineral Development. Implementing the Proposed Action is projected to decrease mineral activity across the study area. These changes by operation type for the Proposed Action are shown in Table 3-12.

The largest potential decrease in mining could result because Plans of Operations would be required for many operations that under the existing regulations would need only a Notice. For all operations the requirement to avoid "significant irreparable harm" might delay or preclude operations. Although BLM is expected to invoke this standard rarely, the waiting and uncertainties of the requirement would reduce mineral activities.

Table 3-12. Changes in Mineral Activity under Alternative 3

Casual Use/ Suction Dredging	Small Exploration	Large Exploration	Small Placer	Large Placer	Small Open Pit	Large Open Pit	Small Under-Ground	Large Under-Ground	Industrial Minerals
-10 to -25%	-10 to -20%	-10 to -20%	-10 to -20%	-5 to -15%	-10 to -30%	-10 to -30%	-10 to -20%	-10 to -15%	-5 to -15%

Table 3-13 estimates the number of Notices and Plans that could be submitted over a 20-year period for different types of mining operations under the Proposed Action.

Table 3-13. Number of Mineral Operations under Alternative 3 over a 20-Year Period

Type of Operation	Notice—Level		Plan—Level	
Exploration	6,050	6,800	700	740
Placer Mine	0	0	2,650	2,980
Strip Mine	0	0	250	280
Open Pit Mine	0	0	1,500	1,900
Underground Mine	0	0	220	250
Mill Site	0	0	490	550
Totals	6,050	6,800	5,810	6,700

From 300 to 340 Notices for exploration and from 290 to 330 Plans of Operations would be filed each year under the Proposed Action. Over a 20-year period, from 6,050 to 6,800 Notices and from 5,810 to 6,700 Plans of Operations would be filed.

Table 3-14. Acres Disturbed under Alternative 3

	Acres Disturbed				
	Per Operation	Per Year		In 20 Years	
Notice Level	2	600	680	12,000	13,400
Plan Level	2-50	6,100	6,900	122,500	143,000

Table 3-14 shows the average acreage that would be disturbed by Notice- and Plan-level operations under the Proposed Action. Disturbance for operations that the Proposed Action would upgrade from the Notice to the Plan level was calculated at 2 acres per operation.

Casual Use/Suction Dredging. Use of suction dredges would require planning further in advance before engaging in the activity. This requirement could reduce the number of suction dredging operations or result in more unauthorized activity on public lands from these operators.

Exploration. Under the Proposed Action, exploration projects disturbing less than 5 acres would continue to submit a Notice to BLM. But Notice-level operations would require reclamation bonding at 100% of the cost of reclamation. This requirement would increase the costs of operations and could economically harm small independent geologists and prospectors, who might also have difficulty obtaining these bonds. The uncertainty of obtaining a bond would affect the entire range of mineral activity.

Mining. All mining would require Plans of Operations. Therefore, mining operations that previously had only to submit Notices would have to submit Plans of Operations. All small operations (only 5 to 10 persons) would now be required to prepare Plans of Operations and environmental documentation. The environmental requirements and the level of detail for any operation would be based on site-specific locations and the type of operation proposed. Many of the small operators could be hard pressed to post the bond for Plan-level operations and meet environmental requirements. The range of decrease in mineral activity (0 to -30%) would result from the uncertainty of obtaining the required data, the amount of data, and the detail of the data and the difficulty of obtaining a bond either through bonding companies or other methods.

Operators would have to post bond at 100% of the reclamation cost of operations. And bonds would be more difficult to obtain because corporate guarantees would not be allowed in future operations.

The requirement to avoid unnecessary or undue degradation could cause operators to question whether a mine can be developed. The potential use of the "significant irreparable harm" standard could significantly discourage the development of mineral properties. BLM is expected to use this standard only minimally to deny operations. But that all activity would have to meet the requirement could greatly increase mitigation costs and operator expenses to the point where some operations would no longer be economically feasible. In addition, applying (or not applying the significant irreparable harm standard is expected to be extensively litigated in the administrative and judicial systems. The uncertainty of development of mineral properties could make industry unwilling to take the financial risk, even for exploration. The uncertainty of the proposal is shown in the range of decrease in mineral activity

Alternative 4: Maximum Protection

Administration of Surface Management Regulations. The use of technical design standards might reduce the flexibility that operations have under the existing regulations and could reduce the level of exploration and mining. BLM would outline to the operator which technical standards to use. If the standards fail to protect the environment, the industry could argue that it would not have to take remedial actions because it has followed the standards and completed the process exactly as outlined. The mining industry could further argue that it is not liable for the damage because of the failure or inadequacies of the technical standard.

Casual Use. Casual use could continue once BLM has reviewed a proposal and determined that an action is casual use or that a Plan of Operations must be submitted. Operators would either have to write or visit BLM to determine if the operation consists of causal use. Having to review proposals and make these determinations would increase BLM's workload.

Notices. Alternative 4 would discontinue Notices, which would significantly affect exploration operators.

Plans of Operations. All actions that do not meet the casual use definition would require Plans of Operations. Operators would have to plan more time to develop mining actions so that BLM could process them. Exploration would have more scheduling problems because it is based on current information that is being developed for a potential target. During exploration, information could change and require operators to change their exploration plans. These changes could delay drilling and the overall operation because of the wait for additional approval. These delays could be costly in time and money. Developing Plans of Operations would be a complicated and time-consuming process.

Under Alternative 4, BLM could deny a mining permit under any of the following conditions:

- The operation could not prevent irreparable harm.
- Wetlands and wildlife habitat could not be reclaimed within 10 years.
- Water would have to be treated for more than 20 years after closure.

These determinations would be based on predictive models and professional opinion, and the predicted impact might or might not occur. These decisions would restrict the mining industry from accessing minerals on public lands.

Alternative 4 would further restrict mineral entry by requiring BLM to perform validity exams for all operations and for common/uncommon variety minerals. Before approving Plans of Operations for mining BLM would also have to develop a feasibility study for proposed mines to determine if mining would be feasible. Preparing these documents would be time consuming and require more expertise on BLM's staff. But these documents would give BLM the information for determining if the project should go forward before any land is disturbed.

Under Alternative 4 industry would use the best available technology and practices for actions on mining operations. These technologies might or might not directly apply to the mining industry.

Operations would also be required to post a bond for 100% reclamation and money for unplanned events. Calculating a bond for unplanned events would be difficult.

Reviewing Plans of Operations under Alternative 4 would increase BLM's workload. Under current funding and staffing levels projects would be delayed.

Inspection and Enforcement. Alternative 4 would require operators to have third-party contractors complete monitoring of the operation, and monitoring reports would have to be given to BLM for verification. The review of these documents would require more time and money for BLM.

If an issue of noncompliance arises, BLM would be required to take enforcement actions and automatically penalize the operator. BLM would issue penalties and could strain the working relationship between the agency and the operator. Mandatory penalties could make it difficult for BLM to attain compliance, would prohibit the approval of other permits, and would further strain working relationships. These types of automatic penalties could make it difficult for BLM and the operator to work out problems. On the other hand, penalties could keep some operations in compliance. Automatic noncompliance could increase BLM's workload. An estimated 1,000 notices of noncompliance for mining are expected to be issued on public lands during a 20-year period under Alternative 4.

Administration practices. Any appeal of BLM's decision would automatically stay the decision. The project would then have to be reviewed by the Interior Board of Land Appeals (IBLA) before the operation could continue. Historic data shows that this requirement could delay a project for up to 2 years. The use of appeals could create a backlog of cases and further delay IBLA's review and the operation. An appeal could be used to stop mining and could effectively shut down operations before they start.

Mineral Development. A mining decrease of 10% to 75% is projected to result from implementing Alternative 4. These changes are shown in Table 3-15.

Table 3-15. Changes in Mineral Activity under Alternative 4

Casual Use/ Suction Dredging	Small Exploration	Large Exploration	Small Placer	Large Placer Pit	Small Open Pit	Large Open Pit	Small Under-Ground	Large Under-Ground	Industrial Minerals
-5 to -15%	-20 to -30%	-20 to -30%	-20 to -30%	-15 to -25%	-50 to -75%	-50 to -75%	-15 to -25%	-10 to -20 %	-10 to -20%

Table 3-16 outlines the possible number of Plan-level operations over a 20-year period under Alternative 4.

Table 3-16. Number of Mineral Operations under Alternative 4 over a 20-Year Period

Type of Operation	Small Operations		Large Operations	
Exploration	5,300	6,050	610	700
Placer	1,770	2,010	560	640
Strip	190	220	45	50
Open Pit	270	540	260	530
Underground	90	100	120	130
Mill Site	340	380	90	100
Total	7,960	9,300	1,685	2,150

Table 3-17. Acres Disturbed under Alternative 4

Operation Size	Acres Disturbed per Operation	Acres Disturbed per Year		Acres Disturbed in 20 Years	
Average Small	2	800	940	15,920	18,600
Average Large	50	4,000	5,500	84,250	107,500

Under the assumptions in Appendix E, from 400 to 470 small Plans of Operations and from 80 to 110 large Plan of Operations could be submitted a year under Alternative 4. Over a 20-year period, from 7,960 to 9,300 small Plans of Operations and 1,685 to 2,150 larger Plans of Operations could be submitted. Table 3-17 shows acres that would be disturbed under these operations.

Exploration. Under Alternative 4 all exploration would be conducted under Plans of Operations. These operations would lose the flexibility they had with Notices and require more time for Plan review. Exploration projects easily change during operations in response to the type of information one receives during drilling. These changes would not be easily managed as modifications to Plans of Operations. The need to visit BLM offices to review projects just for hand samples would also slow the process and cost people and organizations time and labor. People planning outdoor activities would have to plan far enough ahead to talk to the BLM office with jurisdiction before engaging in the activity. With BLM offices often so far away, people might have a difficult time discussing the project and getting it approved before engaging in outdoor recreation. BLM's authority to reject a project would further restrict areas open to mineral exploration and development.

Mining. Operators would experience delays in the permitting process because of all the new information and situations required for Plans. Bonding for 100% plus unplanned events would be difficult to establish for operations. Smaller operations disturbing less that 5 acres would have further delays in getting Plans approved because of the need to collect baseline information. Outdoor activities that before had required only a Notice or were considered casual use might require Plans of Operations. This requirement would restrict access to minerals for these types of operations such as the weekend use of suction dredges.

Alternative 5: NRC Recommendations

Administration of Surface Management Regulations. Alternative 5 would result in increased cost to the mining industry.

Casual Use. Under Alternative 5 casual use should only negligibly disturb the environment. But major problems would arise when groups get together to recreate, explore for minerals, or placer mine for gold. In these situations cumulative impacts could exceed negligible levels, resources would be damaged, and the disturbance would generally not be reclaimed.

Notices. Under Alternative 5 all exploration disturbing less than 5 acres could be operated under Notices. But any mineral activities on special status lands would still require Plans of Operations. Alternative 5 would also require bonding for Notice-level operations. Reviewing and accepting a bond would require more work for BLM but would provide a way to enforce reclamation and mitigation requirements.

Plans of Operations. Plans of Operations would be expanded to include all types and sizes of mining and milling, as well as exploration projects that disturb more than 5 acres or are in special status areas. BLM's workload would increase with mining operations being required to submit Plans of Operations.

BLM would need to review or coordinate several conditions before approving Plans. For Example, Plans of Operations may require a public comment period in coordination with the environmental analysis.

For operations under Plans Alternative 5 would require bonding for 100% of reclamation. Bonding would increase workloads by requiring BLM to review in more detail the reclamation plan. But bonding would allow for a complete interdisciplinary review of the reclamation plan and the complete reclamation of disturbed land if an operator defaults. As a result, mining companies would face more delays in starting or modifying their projects than they now do.

Inspection and Enforcement. Enforcement provisions of Alternative 5 would include the use of suspension orders and discretionary penalties, which BLM could assign for noncompliance. These orders and penalties would slightly increase the workload to develop the case and defend the orders and penalties. But BLM would have more legal recourse to be used against operators who refuse to comply.

Under Alternative 5, during a 20-year period, from 180 to 200 notices of noncompliance and suspension orders could be expected for Notice-level activity. From 230 to 260 could be expected for Plan-level activity.

Administration Practices. Mines proposed either for areas withdrawn from mineral entry or for extracting suspected common variety minerals, could be processed under either a Notice or a Plan of Operations. The operator might not have to demonstrate a valid claim before disturbing the surface. Potential environmental impacts could result, and the Federal Government could lose revenue, if BLM discretion is not used to verify claim requirements before accepting a Notice or approving a Plan.

Mineral Development. Implementing the NRC Recommendations Alternative is projected to decrease mining by 10% or less overall across the study area. These changes by operation type are shown in Table 3-18.

The largest potential decrease in mining could result when a Plan of Operations would be required for an operation that under the existing regulations would need only a Notice. These operations would mainly be small mining operations which were allowed under a Notice but now would be under a plan of operation. The cost model for small placer operations (see Appendix E) projects shows a potential 34% increase in some costs when a Plan of Operations rather than a Notice would have to be prepared.

Table 3-18. Changes in Mineral Activity under Alternative 5

Casual Use/ Suction Dredging	Small Exploration	Large Exploration	Small Placer	Large Placer	Small Open Pit	Large Open Pit	Small Under-Ground	Large Under-Ground	Industrial Minerals
0%	0 to -5%	0 to -5%	-5 to -10%	0 to -5%	-5 to -10%	0 to -5%	-5 to -10%	0 to -5%	-5 to -10%

Table 3-19 outlines the possible number of Notices and Plans that could be submitted over a 20- year period for different types of mining operations under the Proposed Action.

Table 3-19. Number of Mineral Operations under Alternative 5 over a 20-year Period

Type of Operation	Notice Level		Plan Level	
Exploration Placer Strip Open Pit Underground Mill Site	7,180 0 0 0 0 0	7,560 0 0 0 0 0	830 2,980 270 1,970 240 540	870 3,140 290 2,080 270 580
Totals	7,180	7,560	6,830	7,230

Overall, mining is expected to decrease by 10% or less. The decrease would not necessarily to be reflected in the overall number of operations on public lands. The mining industry could absorb these changes through shorter mine lives, high cutoff grades, discontinued exploration, and lower profits.

For these assumptions, from 360 to 380 Notices and from 340 to 360 Plans of Operations would be filed each year under Alternative 5. Over a 20-year period, operators would file from 7,180 to 7,560 Notices and 6,830 to 7,230 Plans of Operations.

Table 3-20 shows the average acreage that Notice- and Plan-level operations would disturb under Alternative 5.

Exploration. Under Alternative 5, operations disturbing less than 5 acres would continue to explore and develop mineral deposits by submitting a Notices. But Notices would require reclamation bonds at 100% of the cost of reclamation. This bonding requirement would increase operating costs for small independent geologists and prospectors, who could not easily obtain these bonds. The difficulty and uncertainty of obtaining bonding could affect exploration operations of all sizes.

Mining. All mining would require Plans of Operations under Alternative 5, and all formerly Notice-level mining operations would eventually require Plans of Operations if they expanded. All small operations (only 5 to 10 people) would have to develop Plans of Operations and environmental documentation. The environmental requirements and the level of detail for any operation would be based on the site-specific locations and the type of operations proposed. Many small operators could be hard pressed to post the required bond at 100% of an operation's estimated reclamation cost. The range of change in mineral activity (-5% to -10%) would result from the uncertainty of obtaining the required data, the amount of data, and the detail of the data and the difficulty of obtaining a bond either through bonding companies or other methods.

Table 3-20. Acres Disturbed under Alternative 5

	Acres Disturbed				
	Per Operation	Per Year		In 20 Years	
Notice Level Plan Level	2 2-50	718 7,400	758 8,870	14,360 149,980	15,120 158,460

Hazardous Materials and Waste Management

Affected Environment

Hazardous Materials Management

The term "hazardous materials" is defined in 49 CFR 172.101. Hazardous substances are defined in 40 CFR 302.4 and in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) Title III. Hazardous materials and substances may be transported, stored, and used at any mine. Typical processing chemicals include sodium cyanide, calcium oxide (lime), hydrochloric acid, antiscalants, flocculants, and sodium hydroxide. Cleaning solvents, blasting agents, and diesel fuel for mining equipment may also be used.

The Department of Transportation has compiled a list of materials classified as hazardous for transportation purposes (49 CFR 172.101) and prescribes packaging and labeling requirements for each designated hazardous material. This list includes the hazardous substances regulated under CERCLA as well as other types of chemicals. In addition to the hazardous substances described above, the transporting of sodium hydroxide, ammonium nitrate, class A explosives, diesel fuel, and calcium oxide (lime) must comply with Department of Transportation hazardous materials packaging and labeling requirements.

Chemicals used in mining must be stored in compliance with a variety of regulations and procedures. Fuel storage areas must be built with synthetic liners or a concrete containment area to store above-ground bulk fuel tanks. All other petroleum products and chemicals must be stored in lined containment areas with at least 110% secondary containment capacity. Lubricants are usually contained in a mobile service truck. Bulk lubricants and petroleum products must remain stored at the main mobile maintenance shop. Sodium cyanide is stored in areas physically separate from acid storage, and blasting agents and explosives must be stored and used on site according to Mine Safety and Health Administration regulations (30 CFR 56, subpart E). Users of blasting agents must maintain a valid Bureau of Alcohol, Tobacco, and Firearms permit.

Some mines are classified as large-quantity generators of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). A large-quantity generator generates more than 1,000 kilograms per month of RCRA-regulated hazardous waste (40 CFR 262). Other mines can be classified as conditionally exempt small-quantity generators of hazardous waste, as defined by RCRA. A small-quantity generator generates less than 100 kilograms a month of RCRA-regulated hazardous waste.

Laboratory waste that exhibits hazardous waste characteristics, including off-specification commercial chemicals and assay wastes, are managed as hazardous waste. A short-term hazardous waste storage facility is built for storing these wastes for up to 90 days. Hazardous wastes are hauled to an approved facility for disposal.

Hazardous wastes other than laboratory wastes are also managed in the short-term storage facility before being shipped to an off-site licensed disposal facility. These materials may include waste paints, thinner, and spill cleanup items. Spent solvents and used oils are returned to recycling facilities.

Waste Management

Mining also generates nonhazardous waste. Most of this waste includes mill tailings, waste rock, spent leach ore, and solvent extraction and eletrowinning wastes ("SX/EW"). Mine waste are excluded from regulation as hazardous waste under the Resource Conservation and Recovery Act of 1976 (RCRA): 40 CFR 261, mining waste exclusion: final rule, Federal Register Vol. 54, No. 169, September 25, 1989: 40 CFR parts 260, 261, 262, Mining Waste Exclusion and Definition of Designated

Facility; proposed rule, Federal Register Vol. 54, No. 184, September 25, 1989; 40 CFR 260, 261, 262, Mining Waste Exclusion; Section 3010 Notification for Mineral Processing Facilities; Designated Facility Definition; Standards Applicable to Generators of Hazardous Waste; final rule, Federal Register Vol. 55, No. 15, January 23, 1990. These wastes are managed on the mine site through the site-specific reclamation or closure plan. Their disposal method depends on their chemical nature and potential to generate leachate.

Nonhazardous wastes generated by mining include waste paper, wood, scrap metal, used tires, and other domestic trash. These materials are disposed of in designated landfills. These sites are usually developed onsite as part of the operating and reclamation plans and are covered under 40 CFR 268. Analytical procedures at an on-site laboratory generate hazardous and nonhazardous waste. Nonhazardous solid wastes from the laboratory are disposed of at the landfill.

To date, the U.S. Environmental Protection Agency (EPA) has not established a regulatory framework for regulating mining wastes under Subtitle D of the Resource Conservation and Recovery Act (RCRA). For purposes of this EIS, BLM assumes that this status will continue. If EPA does establish regulations for mining wastes, BLM would coordinate with EPA.

Emergency Response

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) creates a framework for the federal response to hazardous substance releases. For this program to be effective, the Federal Government must be informed immediately of releases that may require rapid response to protect public health and the environment. Notification is needed if an amount of a hazardous substance equal to or greater than its reportable amount is released to the environment within a 24-hour period. Following notification, federal workers evaluate the need for a federal response, and removal or remedial actions are initiated, if necessary. For emergency response planning under the Superfund Amendments and Reauthorization Act (SARA), Title III, a threshold planning quantity is established for each hazardous substance. The threshold planning quantity and reportable quantity values for sodium cyanide are 100 lbs. and 10 lbs. respectively. CERCLA excludes petroleum products as hazardous substances. If an operation is expected to store

Table 3-21. Outline for Emergency Response Plan

I. Introduction

II. Emergency Coordinator Information; Emergency Phone Numbers (40 CFR 262.34 [d][5])

III. Preparedness, Prevention Contingency Plan
  1) PPC Plan (40 CFR 265, subpart C and ARS 26-347)
    A. Maintenance and Operation of Facility
    B. Required Equipment
    C. Testing and Maintenance of Equipment
    D. Access to Communication or Alarm Systems
    E. Required Aisle Span
    F. Arrangements with Local Authorities
    G. Transportation Routes
  2) Hazardous Waste Training for Employees
  3) Emergency Plan for Hazardous Materials
  4) Disaster Plan
  5) Acid Handling Procedures
  6) Emergency/safety Equipment Lists and Locations; Evacuation Plan and Routes
  7) Spill Prevention Control Countermeasure Plan
  8) Maps, Illustrations

chemicals that exceed their threshold planning levels, an emergency response plan is required.

Mining operations that store, use, or generate regulated materials must have an emergency response plan as required by CERCLA (Table 3-21). Part of the emergency response plan is a spill prevention, control, and countermeasure (SPCC) plan. This plan would cover all materials stored at the mine site and must be reviewed and updated at least every 3 years, or whenever major changes are made in managing these materials.

The emergency response plan outlines actions that would be initiated, and by whom, in event of a release or spill from a component of a fluid management system. The fluid management system includes the process recovery system, piping, pumping, ditches, and other items used in the managing and fluid containment of the leaching and processing facilities. The emergency response plan also applies to spills of stored chemicals and petroleum products. All chemicals must be stored and handled according to manufacturer recommendations and state regulations.

The material safety data sheets for all chemicals used on a mine site and emergency response plan and the emergency response plan itself should be kept where they are readily accessible by workers.

Release and Spill Reporting

Discoverers of chemical or petroleum product spills or accidental discharges from any component of the fluid management system must immediately shut down that portion of the failed system to eliminate the discharge and then notify their immediate supervisors. Procedures should then be followed, in response to the time of the event, including other proper notification of mine workers, as specified in the emergency response plan.

The notification process usually entails contacting local, state, and federal people who have responsibilities in emergency response. Depending on the nature of the release or spill, equal to or greater than that of its reportable quantity, the National Response Center could be contacted. These notifications are based on local, state, and federal requirements and outlined in the emergency response plan.

Environmental Consequences

Impacts Common to All Alternatives

The storage of chemicals, hazardous waste, and other waste is regulated by the acts and regulations outlined previously. None of the alternatives would reduce the effectiveness of emergency responses to releases and spills. The risks of transportation accidents, equipment failure, and human error resulting in a spill or release would continue. The level of risk would be determined by the relative amount of activity and proximity to environmentally sensitive lands and habitats. All spills or releases during any operation will have some form of risk analysis completed to determine the level of cleanup needed to meet all state and federal regulations and determine the natural resource contamination risk acceptable to the land management agency.

These regulations and the expanded regulatory environment have had a cumulative affect on the mining industry's cost of doing business. The new state and federal regulations are requiring more time and monitoring from the operator to meet these new requirements. These types of activities impose costs to operations. These costs range from less than 1% of the total cost of the operations to as high as 20% of the overall operational budget. These cost vary greatly, depending on a mineral operation's site-specific resource concerns.

Land use restrictions from zoning and mineral withdrawals will continue to restrict access to areas for mineral development. The changing policies of agencies in response to environmental degradation, political pressures, and court cases will change how industry will operate on public lands.

New hazardous materials issues are affecting the mining industry. On May 1, 1997, EPA published a final rule to expand the Toxic

Release Inventory Reporting Program under Section 313 of the Community Right-To-Know Act (EPCRA) by adding metal mining, among other industrial groups. Reporting requirements are extensive, and initial reports were due by July 1, 1999. On another waste management issue, in May 1998, EPA published land disposal restrictions for mineral processing wastes. These restrictions include treatment standards based on the performance of best demonstrated available technologies (BDAT). [See 63 Fed. Reg. 28556 (May 26, 1998).] The minerals industry will continue to experience increased regulations and restrictions from state and federal agencies.

Alternative 1: No Action

The improper management of mine waste could affect natural resources. Under current law–the Bevill Amendment– most mine wastes are exempt from the hazardous classification and regulation by legal definition. While some mine wastes might not pass a nonhazardous testing standard, they would still legally be handled as nonhazardous waste. Pond sludge is an example of mine waste that might be technically hazardous yet legally could be reclaimed in place. Depending on how materials are reclaimed, they might leach into soils and ground water. Soils could attenuate heavy metals so that they could be absorbed by plants and enter the food chain.

Although there are no specific standards other than isolation and control of toxic or deleterious substances, the Plan of Operations review process provides a mechanism for BLM to consider mine waste character and provide for waste disposal in an environmentally sound manner on a site specific basis. But mine waste is difficult to manage because some operators are reluctant to test waste that is exempt from classification as a hazardous material. When processing a mining Notice it becomes even more difficult to ensure that mine waste is properly handled because of the limited review times and content requirements.

Alternative 2: State Management

Under some state programs, mine waste might not be characterized adequately to determine its potential for causing contamination. Without knowledge of the material's pollution potential, an operation might not be properly reclaimed. BLM, as land owner, might not know of the waste disposal situation and could be held environmentally and financially liable for the cleanup if onsite disposal later degrades the environment.

Alternative 3: Proposed Action

Under the Proposed Action several factors would reduce the potential for both hazardous and nonhazardous mining-related wastes to harm the environment. Eliminating the Notice provision for small mines would give BLM more opportunity to review, characterize, and plan for proper disposal of mine wastes from these small operations. The addition of reclamation bonding would ensure that wastes are properly disposed of if the operator is unable to do so. The information requirements specified for characterization, reclamation, and monitoring as part of a Plan of Operations would give BLM the information needed to evaluate the potential impacts of mine waste management. Mine waste testing would determine the potential for generating unacceptable leachate. The testing would also ascertain the best approach to reclaiming mine waste disposal areas. The expanded detail in the performance standards would reduce confusion over reclamation requirements when it comes to waste disposal and provide for greater consistency across BLM offices.

Alternative 4: Maximum Protection

Under Alternative 4 potentially toxic mine wastes such as pond sludges and lab wastes could not be disposed of on BLM-administered lands. This prohibition would, eliminate any potential impacts or added cost to BLM from improper disposal of this material. Other mining waste products such as tailings and waste rock could still be disposed of on BLM lands. The Plan of Operations review process would be used to determine the mine waste character, placement, reclamation, and monitoring needs. This process would reduce potential environmental impacts similar to those under Alternative 3. In addition, expanded bond coverage for unplanned events such as spills or facility failures could offset the government's cost in responding to and starting removal or remedial actions for hazardous waste or mine waste environmental releases.

Alternative 5: NRC Recommendations

The elimination of mining under a Notice and the bonding of all mining and milling operations would give BLM more opportunity to review, characterize, and plan for proper disposal of mine wastes from these small operations. The addition of reclamation bonding would ensure that waste is properly disposed of if the operator cannot do so. Alternative 5 would increase the level of environmental protection from improper mine waste management beyond that provided by the existing regulations. But Alternative 5 would not be as beneficial as Alternative 3, with its expanded Plan content requirements and specific performance standards.

Climate

Affected Environment

The study area consists of several major climatic types. Temperatures vary mostly with latitude, elevation, moisture, and to a lesser extent local microclimate. At higher elevations in the study area freezing temperatures are possible throughout the year.

Annual precipitation is highly variable, due mainly to the orographic effect of local topography and the large-scale variability of storm tracks in respect to large water bodies. Except in coastal areas, the Pacific Southwest, and areas with high snowpack, most precipitation comes from thunderstorms in the spring to fall. Snowfall is possible at higher latitudes and elevations throughout the year, with snow accumulation amounts increasing with elevation.

Upper-level winds generally prevail from the west and southwest (with alternating southerly flow in the east), but ground-level winds often reflect local terrain. For example, the diverse and rugged terrain in mountains results in complex wind flows and surface winds. Synoptic (pressure gradient) winds may be channeled or forced around hills, but without strong gradient flows, diurnal upslope/downslope winds predominate. Upslope winds usually blow on sunny mornings when the air at higher elevations heats rapidly and rises. Downslope winds blow when the air near the ground cools, becomes dense, and sinks downward along drainages.

The extent of vertical and horizontal mixing is related to the atmospheric stability and mixing depth. Unstable conditions normally result from strong surface heating (typical of summer afternoons), producing vertical winds. Neutral conditions reflect a breezy, well-mixed atmosphere. Stable conditions (enhanced by rapid radiative cooling and downslope drainage, high pressure systems, etc.) produce the least amount of dispersion.

Although the atmospheric mixing varies throughout the study area, dispersion is normally good in spring and summer, but limited in winter. Inversions are formed under stable conditions, trapping air pollutants within a layer of the atmosphere. Moderate summer inversions are typical during the evening and dissipate at dawn. Winter inversions are stronger and last longer. Inversions are enhanced by weak pressure gradients, cold clear nights, snow cover, and lower elevations.

Public lands in the study area are found in several general climatic regions, including Arctic Alaska, Interior Alaska, Coastal Alaska, Coastal Pacific (North and South), California Central Valley, Columbia Plateau/Snake River Basin, Great Basin, Southwestern Desert, Wyoming Basin, Colorado Plateau, Western Great Plains, Eastern Temperate Plains, and Southern Subtropical Plains. In addition, microclimatic conditions make mountainous, highland climates highly variable, including the Cascade/Sierra Nevada Mountains, Northern Rocky Mountains, and Southern Rocky Mountains climatic regions. Even these regional climatic divisions are necessarily broad generalizations of highly complex conditions.

Environmental Consequences

Although locatable mineral development would not significantly affect climate, it is appropriate to examine the impact of climate on postmining vegetation reclamation (McKee and others 1981). Throughout most of the United States the timing and amount of precipitation are the main limiting factors for vegetation growth. Although temperatures also affect growth, warming temperatures typically dictate when growth begins, not if it will occur. Major exceptions to this assumption include the following:

- Coastal Alaska, the northern coastal Pacific, the eastern temperate plains, and the southern subtropical plains, where precipitation is abundant.
- Arctic and interior Alaska and portions of the Cascades/Sierra Nevada, and northern and southern Rocky Mountains, where extreme cold conditions inhibit plant growth.
- Portions of the Great Basin and the southwestern deserts, where extreme summer temperatures often create both spring and fall growing periods.

By comparing the short-term weather situation to long-term climatic conditions, vegetation managers can adjust the timing and methods for postmining vegetation reclamation. For example, dry soil conditions resulting from multiple years of below-normal precipitation will require excess moisture to adequately prepare vegetation for the growing period. Similarly, extended periods of summer moisture may compensate for a dry spring. Other biological relationships will determine the proper selection of seed and root stock, the occurrence and timing of plant development, and root growth.

Air Quality

Affected Environment

The air quality throughout much of the United States is unknown. Only limited monitoring data exists for most pollutants outside urban areas. But in the undeveloped regions of the West ambient pollutant levels are expected to be near or below measurable limits. Locations vulnerable to decreasing air quality from extensive development include immediate operation areas (mills, power plants, prescribed fires) and local population centers (automobile exhaust, residential wood smoke).

Carbon monoxide (CO) is formed by incomplete combustion of hydrocarbon-based fuels. Elevated CO levels are common in urban areas with significant transportation, residential, and industrial emission sources.

Historically, lead was added to gasoline, and elevated lead levels were found in areas with large numbers of automobiles. Today, elevated lead levels are found only in areas immediately next to operating (and historic) lead mines and smelters.

Nitrogen dioxide is formed when hot combustion gases are released quickly into the ambient atmosphere. Automobiles, fossil-fueled electrical generating facilities, and other industrial combustion are the major sources of nitrogen dioxide emissions.

Ozone is a secondary pollutant, formed under specific atmospheric conditions due to ambient levels of other primary emissions (such as volatile organic compounds and oxides of nitrogen). High ozone concentrations are typically found where these primary pollutants combine in strong sunlight and under relatively stable mixing conditions.

Sulfur dioxide is formed when hydrocarbons (or other materials) containing trace levels of sulfur are burned, including coal-fired electrical generating facilities, mineral products enhancement (such as smelting or roasting of ores), and other industrial combustion sources (particularly using diesel fuels).

Particulate matter concentrations are expected to be higher near industrial areas, towns, and unpaved roads. Inhalable particulate matter (PM-10) levels are high in areas with significant combustion sources (urban areas, industrial facilities, residential wood smoke).

Air quality regulations consist of the National Ambient Air Quality Standards (NAAQS) and the Prevention of Significant Deterioration (PSD) increments (Table 3-22). The NAAQS limit the amount of specific pollutants allowed in the atmosphere: carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and inhalable particulate matter. The U.S. Environmental Protection Agency (EPA) recently established fine particulate matter (PM-2.5) standards, although it will take some time before background measurements and regional levels can be determined. Individual state standards include these parameters but may also be more stringent or include other air pollutants. Air pollutant concentrations are usually measured as micrograms per cubic meter.

Table 3-22. National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments (µg/m3)

National Ambient Air Quality Standards				Prevention of Significant Deterioration Increments		
Pollutant	**Averaging Time (a/)**	**Primary Standard (b/)**	**Secondary Standard (c/)**	**Class I**	**Class II**	**Class III**
Carbon monoxide	8-hour	10,000	10,000	—	—	—
	1-hour	40,000	40,000	—	—	—
Lead	Quarterly	1.5	1.5	—	—	—
Nitrogen dioxide	Annual	100	100	2.5	25	50
Ozone	8-hour	157	157	—	—	—
	1-hour (d/)	235	235	—	—	—
Sulfur dioxide	Annual	80	—	2	20	40
	24-hour	365	—	5	91	182
	3-hour	—	1,300	25	512	700
Particulate matter (PM-10)	Annual	50	50	4	17	34
	24-hour	150	150	8	30	60
Particulate matter (PM-2.5)	Annual	15	15	—	—	—
	24-hour	65	65	—	—	—

Sources: 40 CFR 50.4 through 50.12; 40 CFR 51.166(c) and 52.21(c); 62 FR 38652 and 62 FR 38856 (July 18, 1997).

(a/) Annual standards are not to be exceeded; short-term standards may be exceeded once per year.
(b/) Primary standards are designed to protect public health.
(c/) Secondary standards are designed to protect public welfare.
(d/) The 1-hour ozone standards are to be implemented on an interim basis until the 8-hour standards go into full effect.

Areas that consistently violate the NAAQS because of human-caused activities are classified as "nonattainment" areas and must implement a plan to reduce ambient concentrations below the maximum pollution standards. Under EPA's "Fugitive Dust Policy," areas that violate particulate matter standards but lack significant industrial or population particulate sources to cause such violations are designated "unclassified" (neither attainment nor nonattainment). Most rural areas of the country have been designated as either attainment or unclassified for all pollutants.

As required by the Federal Land Policy Management Act and the Clean Air Act, BLM cannot conduct or approve any activity that does not comply with all local, state, tribal, or federal air quality laws, rules, standards, and implementation plans. Therefore, before any activity potentially affecting air quality can be approved and conducted, project-specific air quality assessments must be conducted to confirm that all requirements will be met. In addition, for activities proposed within nonattainment or maintenance areas (previous nonattainment areas that are now achieving or maintaining the NAAQS), BLM must conduct a separate "conformity" analysis and disclose potential air quality impacts and show that those impacts would meet all requirements.

The Prevention of Significant Deterioration (PSD) program applies in "attainment" and "unclassified" areas, whereby areas are classified by the additional amounts of nitrogen oxide, sulfur dioxide, and PM-10 (inhalable particulate matter) degradation that would be allowed above a legally defined "baseline" level. PSD Class I areas–predominately national parks and large wilderness areas–have the greatest limitations; virtually any more degradation would be significant. Areas where moderate, controlled growth can take place were designated as PSD Class II. PSD Class III areas allow the greatest degree of impacts, although no PSD Class III areas have been designated to date.

Congress designated 158 mandatory Class I areas on August 7, 1977 (Figure 3-1; NPS 2000). Several Indian tribes have also redesignated their lands to PSD Class I. Most mandatory PSD Class I areas are in the mountainous regions (although some are also at lower elevations), and are managed by either the Forest Service, National Park Service, or U.S. Fish and Wildlife Service. A few mandatory PSD Class I areas are jointly administered by BLM and the Forest Service Otherwise, most BLM-administered lands are classified PSD Class II.

Environmental Consequences

Impacts Common to All Alternatives

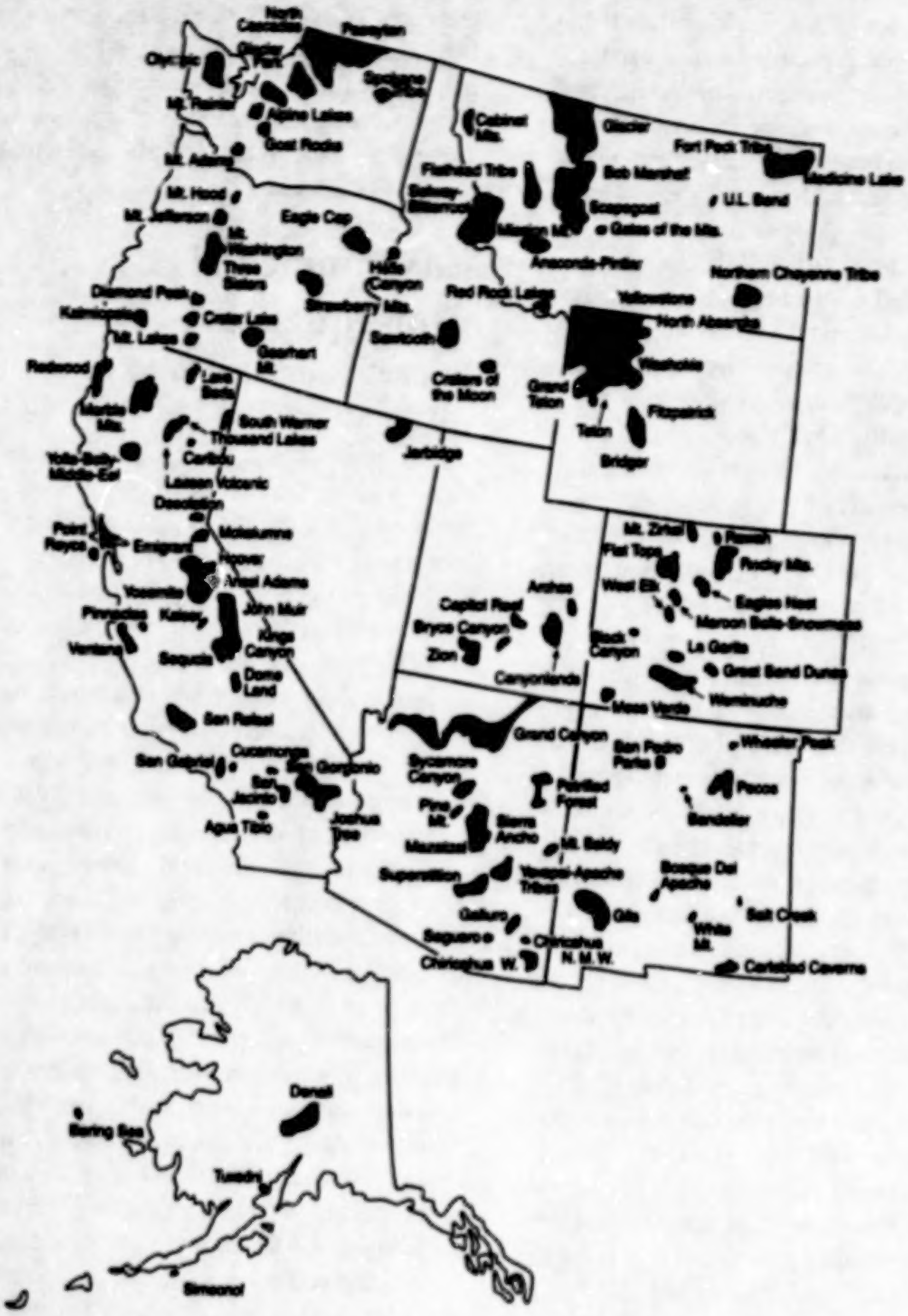
No provisions in the regulations would directly affect the amount and type of impacts to air quality under the four alternatives. Impacts to air quality would result from secondary effects of the regulations on the amount and type of mining activity.

The most significant impacts to air quality under all alternatives would result from direct development (extraction, transport, processing), mineral products enhancement (refining, smelting, roasting, combining), and postmining reclamation. Direct impacts could include increases in noise, dust, and exhaust generated by surface preparation, blasting, extracting, crushing, hauling, secondary processing, and transportation/loadout activities. Depending on the type of material extracted, further enhancement processes can generate large levels of gaseous and particulate matter pollutant emissions, often with relatively tall emission stacks, which can degrade air quality (pollutant concentrations and secondary impacts to visibility and atmospheric deposition) over large areas. Finally, as mining diminishes, continuing particulate matter impacts can be significant due to windblown (or fugitive) dust, until adequate postmining reclamation and vegetation are established and maintained.

Impacts from direct development and product enhancement could be significant (depending on project-specific conditions) but

Figure 3-1

Prevention of Significant Deterioration (PSD) Class I Areas (Source: NPS 2000)



would exist only during the period of development (life of project). Disturbed-land impacts would typically be smaller in scale but could continue until successful postmining vegetation is established.

Because BLM can approve only activities that comply with all local, state, tribal, and federal air quality laws, rules, standards, and implementation plans, this analysis assumes that impacts to air quality would meet these standards. Although the precise air quality impact from mining cannot be quantified now, these procedures would assure that BLM-authorized practices conform to all air quality requirements.

Alternative 1: No Action

Impacts to air quality would continue at about current levels and would be generally proportional to the amount of activity and acreage disturbed. All operations would continue to meet air quality standards as required under the Clean Air Act, state regulations, and the existing 3809 regulations.

An evolving practice used to facilitate metal recovery from sulfide ores is to roast the ore to oxidize and remove the sulfur. This practice emits sulfur dioxide. As part of a general trend, precious metals are being extracted from deeper portions of ore deposits, which contain higher amounts of sulfide minerals. This trend is expected to continue, and sulfur dioxide would be an increasing component in emissions of many mining operations. Although emission levels would continue to be limited under permit systems, sulfur dioxide emissions from the mining sector would increase.

Alternative 2: State Management

Impacts under State Management would be similar to those under No Action. All operations would continue to meet air quality standards as required under the Clean Air Act and state regulations. The projected increase in mineral activity by about 5% would result in a proportional increase in the emission of air pollutants. Although projects would continue to be required to meet standards, there would be a proportional cumulative increase in overall emissions.

Alternative 3: Proposed Action

Impacts under the Proposed Action would be similar to those under No Action. All operations would continue to meet air quality standards as required under the Clean Air Act and state regulations. The projected 5% to 50% decrease in mineral activity would result in a proportional decrease in the emission of air pollutants. In addition, the reclamation measures required by the proposed regulations would improve the reclamation success rate and shorten the amount of time that disturbed areas would be left unreclaimed, thus decreasing the potential for fugitive dust emissions. Projects would continue to be required to meet standards, and there would be a proportional cumulative decrease in overall emissions.

Alternative 4: Maximum Protection

The projected decrease of up to 75% in overall mineral activity and acreage disturbed under Maximum Protection would result in a proportional decrease in the emission of air pollutants. But offsetting this decrease would be the requirement for complete backfilling of all open pit mines. This backfilling would create more fugitive dust and equipment exhaust emissions. On the other hand, restricting the mining of high-sulfide ores would decrease the potential for sulfur dioxide emissions. In summary, projects would continue to be required to meet standards, and there would be a proportional cumulative decrease in overall emissions.

Alternative 5: NRC Recommendations

Impacts under the NRC Recommendations Alternative would be similar to those under No Action. All operations would continue to meet air quality standards as required under the Clean Air Act and state regulations. The projected decrease in mineral activity by about 5% would result in a proportional decrease in the emission of air pollutants. Projects would continue to be required to meet standards, and there would be a proportional cumulative decrease in overall emissions.

Water Resources

Affected Environment

Regional Hydrogeology

The United States can be divided into several ground water regions, each having similar characteristics for the occurrence and movement of ground water (Heath 1984).

Great Basin and Southern Alluvial Valleys. This province includes most of Nevada and parts of eastern and southern California, western Utah, southern Arizona, southwest New Mexico, and small areas in southeast Oregon and Idaho. This region closely approximates the boundaries of the Basin and Range Physiographic Province described by Fenneman (1931), except in New Mexico. The characteristic physiographic features of the Basin and Range Province are the north-south trending mountain ranges and intervening basins filled with alluvial deposits, which can be thousands of feet deep.

This region's ground water occurs in aquifers that are not continuous, or regional, because of the region's complex faulting and the many impermeable mountain ranges that often impede ground water flow between basins. But some basins are part of multi-basin flow systems connected by perennial streams or by subsurface flow through the basin fill or permeable bedrock that separates the basins. Ground water flow through these systems can be continuous for hundreds of miles.

Three main aquifer types collectively referred to as the Basin and Range aquifers (Planert and Williams 1995) are volcanic-rock aquifers, which consist mainly of the following:

- Tuff, rhyolite, or basalt of Tertiary age.
- Carbonate-rock aquifers, which are mainly limestones and dolomites of Mesozoic and Paleozoic age.
- Basin-fill aquifers, which are mainly unconsolidated to semiconsolidated sand and gravel of Quaternary and late-Tertiary age.

Older basin-fill deposits are generally deeper, are more consolidated, and can be less permeable (conglomerate, sandstone, siltstone, mudstone, freshwater limestone, evaporite beds, tuff, and interbedded lava flows). Any or all of these three aquifer types may be in or underlie a basin and constitute three separate sources of water. The aquifers, however, may be hydraulically connected to form a single source. Other rock types within the region (such as schists, granites, shales) have low permeability and block the flow of ground water.

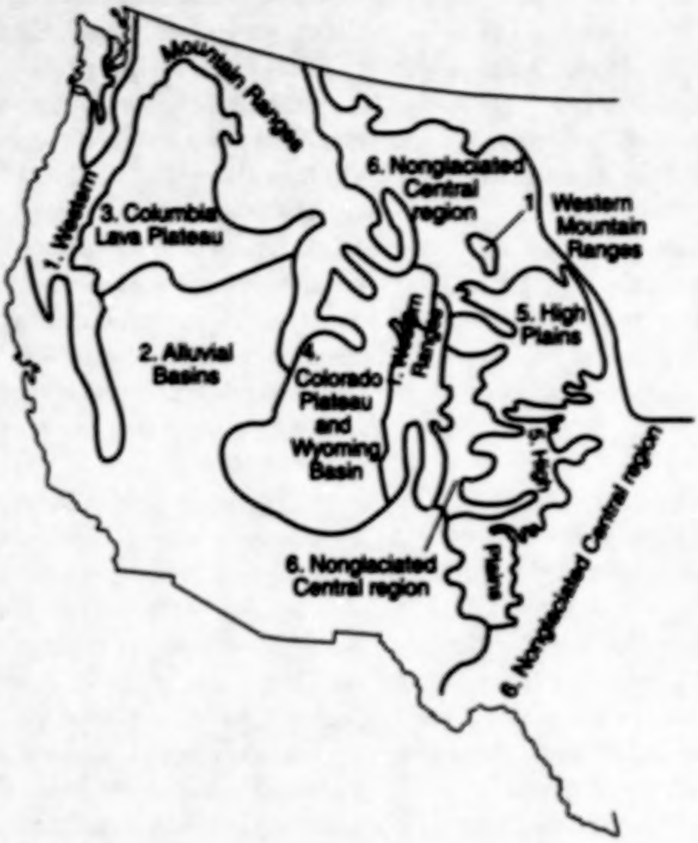
Except for small areas that drain to the Colorado River, no streams that originate within the Basin and Range Province carry water to the oceans. Practically all the precipitation that falls in the area is returned to the atmosphere by evapotranspiration, either directly from the soil/alluvium or from the many lakes and playas in the lowest points of the basins.

The centers of many basins consist of flat-floored, vegetation-free areas known as playas onto which ground water may discharge and on which overland runoff may collect during intense storms. The water that collects in these playas evaporates relatively fast, leaving a thin crust deposit of soluble salts that were dissolved in the water (Heath 1984). These water bodies represent discharge points for the alluvial aquifers (Planert and Williams 1995).

This region is the driest area in the United States. Large parts of it are classified as semiarid and arid. Annual precipitation in the valleys in Nevada and Arizona ranges from 4 inches in the low- lying valleys to 16 inches in some of the high valleys. In the mountainous areas throughout the region precipitation ranges from 16 to 35 inches on the highest peaks (USGS 1985).

Figure 3-2

Ground Water Regions Delineated by Heath (1984)


Mountain Ranges
1. Western
3. Columbia Lava Plateau
6. Nonglaciated Central region
1 Western Mountain Ranges
5. High Plains
2. Alluvial Basins
4. Colorado Plateau and Wyoming Basin
1. Western Ranges
5. High Plains
6. Nonglaciated Central region
6. Nonglaciated Central region

Water quality of unconsolidated aquifers in the Basin and Range Province varies from basin to basin. Water is generally fresh at basin margins and on the slopes of alluvial fans. Dissolved solids concentrations in these areas are generally less than 500 mg/liter. Locally, saline water is present near some thermal springs and where basin fill aquifers contain large amounts of soluble salts, such as aquifers in the upper and middle parts of the Humboldt River Basin. In discharge or sink areas, such as the Carson and Salton sinks and in parts of Death Valley, the dissolved solids concentrations can exceed that of sea water (35,000 mg/liter).

Ground water beneath playas in small closed basins may be brackish, but typically the dissolved solids concentrations are not as high as those in major terminal sinks. Although highly mineralized water is common beneath playas, a deeper fresh water system might be present in some areas (Planert and Williams 1995). Water in bedrock units is generally of good quality, with some variations depending on the rock type and the flow path.

Western Mountain Ranges. This region includes a large extent of mountain ranges in an arc from the Sierra Nevada in California, north through the Coast Ranges and Cascade Mountains in Oregon and Washington, east and south through the northern Rocky Mountains in northern Idaho and western Montana, and south into the Bighorn Mountains in Wyoming and the Wasatch and Uinta mountains in Utah

(Figure 3-2). Collectively this area is referred to as the Western Mountain Ranges ground water region as described by Heath (1984).

These mountain ranges surround the Columbia Plateau regional aquifer, a large area of basalt flows. Most of the area is drained by the Columbia River, its tributaries, and other streams that discharge to the Pacific Ocean. Exceptions are streams that flow to closed basins in southeast Oregon and northern Nevada and to Great Salt Lake in northern Utah (Whitehead 1994).

The region also includes the southern Rocky Mountains, which extend from Laramie, Wyoming, south through central Colorado into the Sangre de Cristo Range in northern New Mexico. The mountain ranges generally consist of granitic and metamorphic rocks flanked by consolidated sedimentary rocks (mainly sandstones, shales, and limestone). Narrow intermontane valleys are filled with relatively thin, coarse, bouldery alluvium erod[illegible]m the higher slopes.

The larger valleys (intermontane structural basins and down faulted troughs) are filled with moderately thick deposits of coarse-grained alluvium deposited by streams washing down from the mountains (Heath 1984). These deposits often form thick alluvial fans along mountain fronts and are recharge areas for water moving into the basin sediments.

Intermontane valleys contain unconsolidated alluvial deposits consisting mainly of sand and gravel layers that can supply large amounts of water to wells. Many large-yield public supply wells and thousands of domestic wells have been drilled in these units. These aquifers are generally not on public land.

The mountains in this region are not considered principal aquifers. Ground water is of limited availability, adequate for domestic use and livestock watering. Ground water in some of the intermontane valleys is more abundant and provides water to wells for large-yield irrigation supplies. Some unconsolidated aquifers occur along stream channels and provide limited amounts of ground water. Depths to ground water can range from a few feet near streams and in the mountains to several hundred feet in the sedimentary deposits that fill the intermontane basins.

Precipitation is high in the mountain ranges of both Oregon and Washington. Up to 160 inches of rain falls annually on the western slopes of the Coast Range. Up to 140 inches of rain falls in the highest peaks of the Cascade Range. In eastern Oregon and Washington, rainfall is much less, and some areas receive less than 10 inches.

The mountains in western Montana receive a little more than 100 inches per year precipitation at the highest elevations. Much of the lower mountainous areas receive 12-40 inches annually. Streamflow is highest from May through June because snowmelt increases flow during the spring and early summer (USGS 1985).

In Wyoming, precipitation is highest in the northwest, averaging about 40 inches per year in the highest mountains. Elsewhere in Montana's lower mountains and plains, precipitation amounts to about 7 inches per year. Major streams in the mountains are the Snake, Bighorn, and Wind rivers (USGS 1985).

Surface water is sustained largely by snowmelt in the mountainous western two-thirds of Colorado. Runoff in the western mountains is highest during spring and early summer, the result of melting snowpack in the Rockies. Mountain precipitation ranges from 12 to more than 30 inches per year. Intermontane valleys receive 8 to 12 inches per year. The Colorado River and its tributaries drain most of the mountain areas. The Arkansas River and Rio Grande and their tributaries drain the region's south.

Colorado Plateaus and Wyoming Basin Aquifers. The Colorado Plateaus aquifers underlie most of western Colorado, northern New Mexico, northeast Arizona, and eastern Utah. The Wyoming Basin includes south-central Wyoming (Figure 3-2). In general, the aquifers in this region consist of moderately to well-consolidated sedimentary rocks that are permeable and in places can store and transmit large amounts of ground water. Most of the aquifers consist of sandstone. But limestone, volcanic rocks, and unconsolidated alluvium also contain water in a few places (Driscoll 1986). The region's main sources of ground water (sandstones) contain water in both primary and secondary porosity in interconnected pore spaces and in fractures. The main aquifers of this region are the following:

- Uinta-Animas aquifer.
- Mesaverde aquifer.
- Dakota-Glen Canyon aquifer.
- Coconino-DeChelly aquifer.

Some locally productive and important aquifers throughout the region are not part of these units (Robson and Banta 1995).

Relatively impermeable confining units separate each of the main aquifers in the Colorado Plateaus. The two thickest confining units are the Mancos shale, which underlies the Mesaverde aquifer and the Chinle-Moenkopi formations, which underlie the Dakota-Glen Canyon aquifer system (Robson and Banta 1995).

Unconsolidated deposits are of relatively minor importance as aquifers in the region. Thin deposits of alluvium that can yield small to moderate amounts of ground water occur along parts of the valleys of major streams, especially next to the mountain ranges in the region's north and east (Heath 1984).

Water levels are generally a few hundred to several hundred feet below ground surface, except in the alluvial deposits near streams. There ground water is generally a few feet to a few tens of feet below ground surface.

Surface water is characterized by sharply incised valleys with many ephemeral streams that drain the lower mountain ranges. Average annual precipitation ranges from about 8 inches in the lower valleys to 40 inches in the highest mountain crests. Major drainages are the Colorado, Yampa, and White rivers in Colorado and the Green River in Wyoming.

Columbia Plateau. The Columbia Plateau, in the ground water region referred to as the Columbia Lava Plateau (Heath 1984), includes eastern Washington and Oregon, southern Idaho, and small areas in northeast California and northern Nevada (Figure 3-2). The region has sequences of lava flows, ranging in thickness from 100 feet next to the bordering mountain ranges to more than 3,200 feet in south-central Washington and southern Idaho (Heath 1984). The lava flows form the region's main aquifer.

Unconsolidated-deposit aquifers are important sources of high-yield wells in some areas and can produce several thousand gallons per minute. More commonly, yields are less than a 100 to a few hundred gallons per minute.

Surface water abounds in the region, with many rivers developed for irrigation and recreation. The area is drained by the Columbia and Snake rivers, their tributaries, and other streams that discharge to the Pacific Ocean (Whitehead 1994). Some drainage is into southern Idaho, and perhaps northern Nevada.

Much of the Columbia Plateau region is in the "rain shadow" east of the Cascade Range. As a result, precipitation is limited over much of the area. Precipitation in the region ranges from 7 to 47 inches per year, but much of the area receives less than 20 inches per year. Many of the smaller streams are dry by summer's end.

Alaska. Aquifers have been mapped in detail only in parts of the widely separated population centers–Fairbanks, Juneau, Anchorage, and Kenai-Soldotna . All water-yielding formations are grouped into two main aquifers–unconsolidated alluvium and glacial outwash deposits, and bedrock. Nearly all ground water development has been in the unconsolidated aquifers. Only about 1% of the water has been derived from bedrock aquifers.

A data base adequate to describe areal variations in the chemical quality of ground water exists only for a few places, mainly near population centers. Most of the unconsolidated aquifers contain ground water of good quality, having less than 400 mg/l of dissolved solids. But saline ground water is present in many of the subpermafrost aquifers in river basins in the central part of the state, for example, in the Copper River Basin. Water quality is affected by the marine sedimentary rocks that underlie much of the basin. Saline waters are also found in the coastal areas, having dissolved solids concentrations of up to 6,400 mg/l (USGS 1988).

From the standpoint of ground water availability and well yields, Alaska is divided into three zones. In the zone of continuous permafrost, ground water occurs beneath the permafrost and also in small, isolated, thawed zones that penetrate the permafrost beneath large lakes and deep holes in the channels of streams. In the zone of discontinuous permafrost, ground water occurs below the permafrost and in sand and gravel deposits that underlie the channels and floodplains of major streams. Water in this zone, contained in silt, clay, glacial till, and other fine-grained deposits, is usually frozen. In the zone not affected by permafrost, which includes the Aleutian Islands, the western part of the Alaska Peninsula, and the southern and southeast coastal areas, ground water occurs both in the bedrock and in the relatively continuous layer of unconsolidated deposits that mantle the bedrock (Heath 1984).

Recharge of aquifers occurs only when the ground is thawed in the areas not underlain by permafrost. This period lasts only from June through September. Because the ground is frozen even in nonpermafrost areas, relatively little recharge occurs in interstream areas by infiltration of water across the unsaturated zone. Instead, most recharge occurs through the channels of streams as they cross alluvial fans or flow in alluvial fill valleys. Infiltration rates can be high in some of the coarser alluvial sediments (Heath 1984).

Impact of Mineral Activity on Water Resources

Exploration for mineral deposits involves drilling; developing shafts, inclines, or adits into the ore deposit; and digging test pits or trenches. Drill holes from exploration can affect water resources. If the drill hole is not plugged or is improperly plugged, water from different aquifers can mix. This mixing can degrade the water quality of all or several aquifers.

Hydrologic investigations are sometimes part of an advanced exploration phase, requiring the drilling of water wells for aquifer tests to evaluate the expected aquifer zones or to evaluate aquifer characteristics. Monitoring wells may be installed to monitor ground water levels before mining. Determining water quality before mining is often part of the final phase of exploration and ore delineation.

These activities normally would not seriously affect water resources except in rare cases. Large amounts of water are sometimes pumped during the late exploration phase to test aquifers or to remove water from development workings. Discharge of the pumped water can be of concern if the water quality is poor. Pumped water is sometimes reinjected or infiltrated back into the ground using ponds. The disposal water can contain elevated levels of soluble salts, trace metals, and chlorides.

Mining can degrade ground and surface water quality and quantity in several ways. Each mine has features such as extraction areas and mill facilities that can affect water resources.

- Mineral extraction areas or pits for removing mineral material for processing. These extraction areas affect water resources through dewatering, creation of pit lakes, aquifer disturbance, and physical removal or rerouting of water courses. Ground water quantity is affected by the removal of ground and surface water through dewatering.
- Waste material storage in either tailings impoundments or waste rock dumps where high- volume waste material is placed. Waste materials affect water resources though acid rock drainage, spills or leaking of ponds, and other leaching of heavy metals.
- Chemical or physical processing plants that extract or concentrate the desirable mineral for refinement or use. These plants include heap leach facilities, placer gold separators, and flotation plants. Water resources are affected through chemical spills and leachates from processed material.

- Ancillary facilities such as access roads, powerlines, lab buildings, maintenance sheds, and other facilities and features needed for mining. Water resources are affected mostly through erosion and increasing sediment loading during runoff events.

Dewatering. Required when mining below the water table, dewatering is the process by which several wells are installed around the pit area and pumped until the water table is lowered below the operating mine pit floor. Mineralization usually occurs in areas of significant faulting and fracturing of the rock strata. As a result, mining sometimes intercepts highly permeable zones, with resulting high inflows of water into the excavation area. Pumping is typically in the deeper zones in the bedrock. Where there is a hydraulic connection (no impermeable geologic unit separating the shallow aquifer and the deeper aquifer) between the overlying alluvium and the mined bedrock aquifer, pumping can lower water levels in the overlying alluvial aquifer as well, near the mine.

The shallow aquifer in the area surrounding the mine does not always drop. Often an impermeable or semipermeable layer of clay or silt separates the shallow alluvial and bedrock aquifers. In the Humboldt River Basin in northern Nevada, for example, many of the shallow alluvial aquifers have not declined at the same rate as water levels in the bedrock aquifers, or water levels have remained fairly constant (Maurer and others 1996). Whether shallow aquifers are affected or not during dewatering depends on geologic factors and hydraulic characteristics of the shallow aquifer and the presence or absence of confining layers.

The effects of dewatering may not be evident for several years until the cone of depression deepens and expands beyond the mine area. In the first stages of dewatering, the cone of depression is limited to the mine area. As the pit is deepened and pumping continues and the rate increases, the extent and magnitude of drawdown increases. Sometimes the cone of depression expands to a radius of several miles around the mine and deepens several hundred feet near the mine. The amount of decline and extent of the cone of depression depends on the pumping rate and the physical and hydraulic characteristics of the aquifers intercepted by mining.

The cone of depression may not always be circular. Lateral variations in hydraulic conductivity (permeability) can cause the cone of depression to elongate. Or the cone of depression could extend further in one direction than another, in response to ground water barriers. In strata where transmissivities are low, the cone of depression would be deep but limited in extent. Where transmissivities are high, the cone of depression could be widespread but would typically be shallow. The cone of depression continues to expand for several months or years even after pumping ceases.

Discharge water from dewatering is pumped into holding reservoirs, injected into aquifers, or discharged into existing streams. Regulated by permits issued by the state, these discharges must meet state National Pollutant Discharge Elimination System (NPDES) permit standards. In the Humboldt River Basin, for example, any discharge water pumped into the Humboldt River would be under an NPDES permit. s

Dewatering requires high pumping rates. Useful examples of pumping rates required for dewatering can be found at the large open pit gold mines in operation in northern Nevada. For example, total pumpage at the Gold Quarry and Post-Betze Mines, the two largest mines along the Carlin Trend, (north of Elko, Nevada) was 100,000 acre-feet in 1993. Pumpage was projected to increase by another 30% by 2000 and then decrease in later years (Maurer and others 1996). Pumping for dewatering will continue for several years at these mines. At the Lone Tree Mine, 60 miles southwest of the Gold Quarry/Betze Mines, initial pumping rates of 10,000 gallons per minute (gpm) were used, increasing to 25,000 to 30,000 gpm in 1994-95. Pumping rates are expected to increase to a maximum range of 75,000 gpm just before the end of dewatering in 2006 (BLM 1995b).

The U.S. Geological Survey (USGS) studied ground water withdrawals in the Humboldt River Basin, and predicted future ground water declines due to dewatering at mines in 34 hydrographic areas that make up the Humboldt River Basin (Crompton 1995). USGS researchers used a 5-year period, 1995-2000, as the time frame for estimating impacts. These initial assessments can be useful for evaluating cumulative impacts of mining.

The USGS categorized potential impacts by distance from a mine, using local distance (less than 2 miles), areal distance (2 to 6 miles), and regional distance (more than 6 miles). The following estimated drawdown conditions summarize the study.

At the **local distance** water level drawdowns near at least one mine in each of 11 hydrographic areas of the basin may reach a maximum drawdown of 100 feet or greater from 1995 to 2000. In eight other hydrographic areas, drawdowns may potentially reach a maximum of about 20 feet or greater but probably less than 100 feet (Crompton 1995). Some of the local drawdowns have been substantial. For example, at the Post-Betze Mine (as of 1994), water levels declined more than 800 feet beneath an area of about 3 mi2 near the mine, more than 100 feet beneath about 24 mi2, and more than 10 feet beneath about 40 mi2 (Maurer and others 1996).

At the **areal distance** the maximum predicted drawdown of 100 feet or greater decreases to 5 hydrographic areas, and 10 hydrographic areas could have drawdowns of 20 feet or greater, but probably less than 100 feet (Crompton 1995).

At the **regional distance** the maximum predicted drawdown of 100 feet or greater decreases to only one hydrographic area, and three other hydrographic areas are predicted to have drawdowns of about 20 feet or greater but probably less than 100 feet (Crompton, 1995).

The greatest impacts involving water level declines are thus limited to the local area near a mine. But water level impacts are seen across a wide area encompassing several hydrographic areas. The drawdown impacts decrease with increasing distance from the mined area.

Cumulatively, the long-term impacts of dewatering will expand beyond the local areas, so that beyond the 2-mile radius of the mine, drawdowns will become deeper. But predicting the ultimate drawdown at single mines or cumulatively is uncertain because geologic factors can affect the rate of expansion and the ultimate size of the cone of depression, even if the pumping rate stays constant. Cumulatively, mine dewatering can bring about changes in streamflow, springs, fish and wildlife habitat, and agricultural uses. In the Humboldt River Basin, Crompton (1995) estimated that six hydrographic areas had a high potential for change due to mine dewatering from 1995 to 2000.

Effects on Streamflow. Dewatering of aquifers can reduce streamflow either by lowering shallow ground water in alluvial channels along streams or by lowering water levels in deeper aquifers that are hydraulically connected to the stream. Dewatering the alluvium reduces streamflow by eliminating the source of water contributing to streamflow, or by causing streamflow to drain through the stream bottom because of the disconnection between the aquifer and the stream.

This drainage can be substantial if the hydraulic conductivity of the streambed is high and can result in the stream going dry. But in many cases either the streambed has low hydraulic conductivity or a confining clay layer separates the bedrock aquifer and the stream. In these situations, streamflow may not be affected, or the decrease in streamflow could be minimal because the upper aquifer is not affected by the dewatering.

Streamflow can also be affected when discharge from dewatering wells flows directly into an existing stream. Or streamflow can be affected by ground water discharge into the stream from shallow alluvial aquifers that convey the pumped water from the dewatering discharge area to the stream. Bank storage from this mechanism can slowly release ground water into the stream, augmenting the streamflow when streamflow decreases due to climatic factors. Large increases in streamflow from this source can disturb riparian habitat along the stream banks, inundating the riparian vegetation or destroying it by rapidly flowing water under high flow conditions. Fish and certain birds that use riparian habitat could be harmed by streamflow changes.

Effects on Springs. Dewatering does not always result in springs drying up or reduced flows. Because many springs are in mountainous areas and are the result of perched, shallow- flow systems that are not connected to the regional aquifer system, some springs are unaffected by lowered ground water levels caused by dewatering (Crompton 1995). When springs are affected, most of the effects are observed near the mine and the dewatering well field.

Effects on springs can occur several miles away if a spring is supplied by the shallow flow system that is affected by the dewatering. If there is no hydraulic connection between the deep aquifer that is denatured and the overlying shallow aquifer, springs may not be affected at all. Or the decrease in flow could be minimal.

Loss of springflow can also affect wildlife that depend on the water source, and in the case of large springs, riparian habitat may be destroyed.

Effects on Shallow Ground Water. Shallow ground water is expressed by the presence of grasses and shrubs. Generally, water levels less than 15 feet below the ground surface are considered to be in the shallow ground water system (Crompton 1995).

Dewatering effects are more pronounced near mines and typically decrease with increasing distance from mines. Dewatering sometimes affects shallow ground water systems within a radius of a few miles around the mine. But in the Humboldt River Basin water levels in the shallow basin-fill aquifer have not declined at the same rate as in the deeper bedrock aquifer. In some cases, water levels in the shallow aquifer do not changed at all or only slightly change, for example in the area near the Gold Quarry and Post-Betze mines in Nevada's Carlin Trend (Maurer and others 1996

Effects on Agricultural Irrigation. Drawdown from agricultural irrigation wells can be significant, ranging to more than 80 feet depending on pumping rates and aquifer conditions. As of 1993, agriculture was the largest water use in the Humboldt River Basin. The effects of mine dewatering could lower ground water levels and increase the costs of pumping irrigation water or require the deepening of wells, which could render irrigation economically infeasible (Crompton 1995).

Pit Lakes. When mining ceases in an open pit being mined below the water table, dewatering is no longer required, and pumps are turned off. Ground water then begins to flow back toward the mine, driven by the hydraulic gradient of the lowered water level at the mine. Several decades may pass before the ground water system approximates premining conditions. As the pit fills, mineral constituents will be leached and transported into the pit with the ground water flow. The ultimate composition of pit lake water quality is variable, depending on the following:

- Host rock for the ore.
- Type of ore deposit.
- Water type.
- Rates of inflow.
- Climatic conditions.
- Reactions between the pit wall and ground water.

Acidic water often results.

Pit lakes may become alkaline in desert environments due to the high evapoconcentration and the low levels of sulfides. Climatic conditions are an important consideration in estimating pit lake water quality. Evapoconcentration in desert environments can change the chemistry of shallow pit lakes. Geothermal water flowing into the pit can cause stratification and overturning of the lake. Reaction with the wall rock is an important factor in determining pit lake water quality (Macdonald and others 1994).

Ground water outside the pit may be affected if the regional hydraulic gradient moves water through the pit and away from the mine. Fluctuations of the water level in the pit can change the direction of flow from or into the pit.

Experience with precious metal pit lakes is limited, especially with deep pits that have only recently been developed. Most of the deep open pit mines in Nevada are still in production and in the process of dewatering (Macdonald and others 1994). Eight pits lakes are now on public lands in Nevada. Pit lakes also form in copper and uranium mining. Water in open pit uranium mine lakes is generally unfit for any use (Macdonald and others 1994).

Ground water quality surrounding many pit lakes is not expected to be affected for several years or decades after pumping stops. The time required for possible impacts to the surrounding ground water quality would vary, depending on the hydrology at the mine site. Normally, ground water flows into the pit for several years after mining. Sometimes decades are needed for the ground water system to reach pre-mining or steady-state conditions. Contaminants do not flow out of the mine pit lake until the hydrologic regime reaches steady state (equilibrium with the flow system). Once steady-state conditions are achieved, ground water might begin to flow out of the mine pit in the direction of the regional hydraulic gradient. At some mines, flow-through conditions can occur early after pumping stops, and the pit is only partially refilled.

Predictions of pit water quality apply geochemical models that use data from laboratory tests of rock content, acid-generating capacity, and hydrologic monitoring data. The following important factors affect water quality in mine pit lakes:

- Pyrite oxidation and acid generation in the pit walls.
- Leaching of metals from wall rock.
- Chemical reactions and evaporative concentration in the water.
- Chemical and oxygen distribution in the final lake.

Water quality in pit lakes changes during filling due to the interaction of pit lake water with different zones of alteration in the pit walls.

Some pit lakes are close to neutral in pH and do not turn acidic. At the Nickel Plate Pit (a gold deposit) near Hedly, British Columbia, for example, the pH of the pit lake is 7.8-8, and the lake has not turned acidic (Macdonald and others 1994). At perhaps the largest expected pit lake in North America, the Betze Pit in northern Nevada, which is an active mine, the final pit water quality is not expected to be acidic (Drever 1991).

Bass planted years ago in the Cortez Mine pit lake in Nevada continue to exist. The fish have no apparent secondary food source, suggesting that the pit lake has enough primary productivity for a food chain that supports the fish (Macdonald and others 1994). But this pit lake is relatively shallow (about 80 feet deep), and conditions differ from deeper pits where lakes will be about 1,000 feet deep.

Several other pit lakes in Nevada are predicted to have water in the neutral range of pH or slightly alkaline. If lakes are alkaline, water quality problems can also develop with elevated levels of contaminants such as arsenic, selenium, molybdenum, vanadium, and nickel.

Attenuation processes can sometimes reduce the contaminants migrating out of the pit. Some studies have shown that attenuation is an important process in reducing concentrations of contaminant plumes but may not always be effective in attenuating all of the contaminants. At the Lone Tree Mine, for example, seepage from the pit lake into the surrounding aquifers is not expected to affect ground water quality because of expected attenuation of the contaminants (BLM 1995b).

Mine pits high in sulfide rock tend to have poor quality water. The pH may be low (acidic) or high (alkaline), depending on the amount of acid-neutralizing and acid-generating capacity of the sulfide rocks. Oxidized mineral zones that contain appreciable amounts of carbonate rock are likely to produce near-neutral pH water quality (near pH 7.0). Because deeper mines are more likely to encounter sulfide minerals, the potential for poor water quality in pit lakes in these deposits is increased.

Water quality in pit lakes can be a transient phenomenon, especially in deep pits. Water inflows in the early stages of refilling can become acidic because of the flow through of sulfide minerals that have oxidized in the pit walls. But as the pit fills, water can encounter acid-neutralizing rock that makes the pH more neutral if the rock has enough neutralizing capacity (Miller and others 1996).

Impacts to ground water down gradient from a mine depend on whether the pit lake is in a flow- through system or a terminal flow system. In a flow-through system, ground water flows into the mine pit and passes out of the pit, migrating down gradient away from the pit lake. In a terminal flow system, the pit captures all ground water that flows within a certain distance of the pit, but water does not pass through the pit. Pit lakes can have terminal flow during filling but then change to flow-through conditions after the pit lake fills to the level of premining hydrologic conditions.

Backfilling of mine pits is one method of reclamation for open pit mining. But backfilling may not always be the preferred option for reclamation where the backfill will be saturated after mine refilling. The resulting water quality might become further degraded because of the leaching of metals and other constituents from the broken and crushed rock in the backfilled material.

Managing the backfilled material (i.e. segregating rock types and placing acid-forming rock types within areas of acid-buffering rock) is important in any attempt to backfill a pit. A full understanding of the regional ground water flow system in mined areas is important so that the ground water flow through closed pits can be more accurately estimated. In addition, backfilling requires an understanding of potential water-rock interactions to predict water quality and pH in the backfilled pit after filling. Whether the water turns acidic is not the only concern. Alkaline conditions can also create water quality problems, with elevated levels of arsenic, molybdenum, uranium, vanadium, manganese, and nickel.

Aquifer Disturbance. Mineral exploration and development can disturb aquifers, but most of the impacts occur during the developing of extraction areas. Open pit and to some extent strip mining removes the permeable geologic strata that may serve as aquifers. Large sections of aquifers can be removed during either open pit or strip mining. Geologic materials can be replaced in the excavation as backfilling material, but the geologic materials would not be the same as in the original aquifer.

Ground water might not flow through these materials as readily as before, or might flow more easily, depending on the material's hydraulic characteristics. As a result, backfilling could disrupt the local ground water flow system and alter ground water flow paths on a local level, possibly changing the ground water regime in the mined area.

Physical Disturbance of Surface Hydrological Systems. Impacts to surface water resources could include the following:

- Changes in water quality.
- Disruptions to the ground water flow system supporting riparian vegetation.
- Changes to stream channel geometry.

Surface water courses are diverted from their historic channels and rerouted around the mine if they cross the proposed mine area. These channels might be replaced after mining is completed through reclamation. But these channels usually do not have the same morphology as the original channel or stream.

The floodplain deposits through which the stream channel passes could affect streamflow characteristics, increasing erosion and changing the frequency and duration of floods. Disrupting the stream channel could destroy the surface water-ground water interaction, harming riparian vegetation.

Acid Rock Drainage. Acid rock drainage (ARD) results from weathering reactions between sulfide-bearing rocks and air and water to generate sulfuric acid. Acid rock drainage is characterized by low pH; increasing acidity; and elevated heavy metals, sulfate, and total dissolved solids in drainage waters emanating from the sulfide rock source. Acid rock drainage can affect water by lowering pH, dissolving minerals, and releasing toxic metal cations (e.g. lead, copper, silver, manganese, cadmium, iron, and zinc). The mobility of heavy metals is also increased in a low pH environment, which allows their transport by ground or surface water. Acidic conditions can be generated in underground mines or in pit lakes formed after open pit mining has ceased.

Acid generation at mines largely results from oxidation of metallic sulfides. The major metallic sulfide of concern is iron sulfide (FeS2), or pyrite. Other metal sulfides can also contribute to acid generation: galena (lead sulfide), sphalerite (zinc sulfide), and chalcopyrite (iron copper sulfide) (EPA 1997).

Pyrite oxidation is a self-maintaining mechanism. The rate increases with lower pH, which results in the oxidation of more pyrite, generating more oxidation agents, which further lower the pH, continuing the cycle. This process can originate from mine pit walls, mine shafts, tunnels, or waste dumps, and can theoretically continue until all the available sulfide has been oxidized. This process can possibly take centuries or millennia to run to completion (Bird 1993). The reaction process can be slowed significantly by cutting off the water or oxygen supply to the sulfide-bearing minerals.

The oxidation process that generates sulfuric acid normally progresses slowly, but the presence of bacteria can accelerate the process. Biological oxidation enhanced by *Thiobacillus ferrooxidans* and other organisms can increase the oxidation rate by 50 to 1,000 times or more. The time required for acidic conditions to develop depends on the amount and character of the sulfides present, and the alkali minerals available for neutralization (EPA 1996).

The ability of a rock sample to generate net acidity is a function of the relative content of acid- generating and acid-consuming minerals and their size, shape, and distribution throughout the deposit. Typical sediment-hosted precious metal deposits in Nevada contain acid-generating and acid-consuming minerals. The balance between the two determines the extent to which rock- water interaction produces acidic water (Bird 1993).

Recorded pH values from acid rock drainage are as low as *less* than -1.0 (Iron Mountain, CA), but acid rock drainage rarely attains levels below a pH of about 2.0 and typically is in the range of 2.0-4.0 (Bird 1993).

No easy or inexpensive solutions exist to acid rock drainage. Two main approaches to addressing acid generation are (1) avoiding mining deposits with high acid-generating potential and (2) isolating or otherwise special handling wastes with acid-generating potential.

Physical, chemical, and biological controls can be used to prevent, minimize, and treat acid rock drainage. The best environmental controls and the least expensive in the long run are waste management practices that focus on prevention rather than treatment.

Acid rock drainage can be treated using two strategies: (1) active chemical treatment of acid by- products or (2) elimination of acid-generating reactions (SME 1998). For waste piles, the use of covers to isolate the wastes from precipitation and to reduce the interaction of oxygen with pyritic mining wastes is an effective means of slowing the generation of acidic drainage from the waste pile. But this method may not be totally successful, and active treatment may still be needed.

For underground mines, bulkhead seals have been used to minimize oxygen flow into mine workings. Preventing oxygen from contacting sulfide mineralization inside the mine workings can greatly reduce the amount of acid and sulfate products generated (SME 1998). Fractures and fault zones within underground mines can also be grouted to reduce the following:

- The contact of oxygen and water with sulfide mineralization and thus acid generation.
- The volume of water in the mine.
- The chance for leakage through fractures or around the bulkhead.

Although testing methods used to predict acid rock drainage have improved in recent years, the results are often uncertain, and mines can sometimes develop unpredicted acid rock drainage after only a few years.

Tests to predict acid-generating potential may be static or kinetic. Static tests are conducted quickly and are based on determining the balance between acid generation and acid neutralization. Kinetic tests mimic weathering processes in the environment at an accelerated rate.

Kinetic tests should be conducted for at least 20 weeks and might be required for much longer. A year or more in some cases is required to get reliable results. But kinetic tests don't consider the accelerated reaction rates due to catalyzing bacteria and can under predict acid generation. Mineralogy and other factors affecting the potential for acid rock drainage vary from site to site and can result in predictions that greatly differ from what takes place at the mine.

Tailings Impoundments. Tailings impoundments have been used at ore mills in the United States since the early 1900s. In recent years these impoundments have become increasingly important in mining and may account for as much as 20% of the cost of a mine or mill project (EPA 1985). Tailings impoundments do the following:

- Retain water so it can be used in the mill flotation circuits and other processes.
- Serve as equalization basins, which help in the process control of wastewater treatment and reagent addition control.
- Protect the quality of surface waters by preventing the release of suspended sediment and dissolved chemicals.

Gold tailings impoundments receive cyanidation process wastes; have high concentrations of cyanide, arsenic, cadmium, lead, mercury, and selenium; and are typically alkaline. The strongest indicators of the leakage of tailings ponds into ground water are the presence of constituents added during beneficiation: chloride and cyanide. Tailings impoundments can leak contaminants into ground and surface waters.

Potential effects of cyanide on water resources are related to cyanide's mobility in water. An EPA study of cyanide showed that some forms are mobile whereas others are less so. Transport mechanisms depend on the type of cyanide and the media through which it travels. High pH and low clay content increase cyanide mobility in ground water systems (EPA 1985).

Operations dispose of more than half of all mine tailings in tailings impoundments, whose use is the main method by which tailings are disposed and wastewater is treated. In addition, mining and mineral processing operations typically use settling ponds. The size and design of tailings ponds vary by industry segment and mine location. Some copper tailings ponds in the Southwest cover 600 to almost 1,000 acres, and one exceeds 4,900 acres (EPA 1985). A Bureau of Mines study in 1981 surveyed 145 tailings ponds in the copper, lead, zinc, gold, silver, and phosphate industries. The average size of these tailings ponds is about 500 acres (EPA 1985).

Possible impacts to water resources from tailings ponds include the following:

- Spills due to failure of the tailing impoundment berm.
- Surface water contamination from runoff.
- Seepage of leachate into the ground water.

Leachates that may percolate downward into ground water, such as by leaking from a tailings impoundment, are not specifically regulated by the Clean Water Act (CWA) (because the act excluded ground water) except where this water may contaminate surface water by emerging at springs and seeps (National Research Council 1979).

In two cases (1979 and 1994), however, the courts have interpreted the CWA broadly and held that tributary ground water is protected (Cavanaugh 1998). In an earlier case (1977), the court held that ground water was not covered under the CWA. Tributary ground water is ground water that is hydraulically connected to surface water. Thus, ground water in unconsolidated alluvium (sand and gravel) or any aquifer that is hydraulically connected via leakage between an upper aquifer and a lower aquifer may be interpreted as being tributary water.

Such interpretations are left to the courts. (See discussion of tributary water in *Colorado Dept. of Natural Resources v. South Western Colorado Water Conservation Dist.*, 671 P.2d 1294, 1300 n. 2 (Colo. 1983).) Case law on this issue is still evolving, and without legislative change to the CWA, the courts will address the issue on a case-by-case basis.

Impacts can result from leakage of tailings ponds used in several mining sectors. EPA studied tailings disposal at eight mines for copper, gold, lead, uranium, and phosphate. Ground and surface water monitoring at each site found evidence of some leakage of solute at most sites. But constituents did not reach concentrations high enough to be of concern, and no evidence was found that the plumes migrated over long distances (EPA 1985).

Revegetation of tailings is inherently difficult, regardless of the ore mined, because tailings are not amenable to supporting higher plants. Water is an extremely limiting factor in revegetation tailings. Where the precipitation exceeds 20 inches, revegetation problems are simplified. But reclamation in the arid West and at high altitudes or high latitudes requires special techniques and comparatively greater effort (National Research Council 1979).

Physical and Chemical Processing Plants. A variety of physical and chemical processes increase the concentration of valuable metal. Operations dispose of the waste material either in waste rock dumps or tailing impoundments.

Spills. Accidental spills of chemicals used in metal extraction and processing could contaminate surface and ground water.

Leachate. Many mines use heap leaching of gold ores to extract minerals from low-grade deposits. For gold and silver heap leach operations, the heap is typically leached with a sodium cyanide solution. Conventional heap leach pads are generally smooth, relatively flat surfaces that are gently sloped in one or two directions to direct the flow of leachate into collection ditches along the pad margins (Buck and Bayer 1989).

Heap leach facilities have leak detection features and sometimes use double liners, often a clay liner and a polyvinyl chloride (PVC) liner. Berms normally surround the facilities to ensure that leachate solutions do not escape into the environment should a heap leach pad fail.

Heap leaching processes present a different set of possible effects to water resources than do mining operations. Seepage of leaching chemicals (e.g. cyanide in base metal flotation and in gold extraction, sodium hydroxide and organic flotation compounds) from heap leach pads or from spills can contaminate ground water. In some hydrologic regions ground water levels are several hundred feet below the surface, and contaminants can greatly weaken before a leak reaches the water table. In many alluvial environments operations must pay special attention to monitoring and preventing the contamination of shallow ground water.

A major hydrologic concern consists of siting heap leach facilities in recharge zones. Some leaching facilities, especially those in the Basin and Range Province, are either in mountainous areas or on alluvial fans along the margins of mountain ranges. These alluvial fans are areas of aquifer recharge (Buck and Bayer 1989). Location of heap leach pads in areas of shallow ground water increases the potential for ground water contamination should a liner leak or the pad itself fail.

Except for system leaks and controlled discharges, spills of cyanide heap leach solutions most often result from the inability of the heap leach system to contain runoff. Interception of precipitation and surface runoff by impoundments containing cyanide decrease cyanide concentrations in the impounded solutions. A leach solution spill could have disastrous to inconsequential impacts. The effects of a spill depend on many factors, including the type of media into which the spill infiltrates, concentration, pH of the solution, ambient air temperature, and volume and chemistry of the receiving waters (Stanton and others 1986).

Cyanide is a highly reactive and relatively short-lived contaminant (Stanton and others 1986). Several processes are potentially significant in the natural degradation or depletion of cyanide in effluents from many gold processing operations: volatilization, oxidation, biodegradation, photodecomposition, and cyanide-thiocyanate reactions (Stanton and others 1986).

Overall, cyanide can cause three major types of impacts.

- Cyanide-containing ponds and ditches can present an acute hazard to wildlife and birds. (Tailings ponds present similar hazards but less often because of lower cyanide concentrations.)
- Spills of cyanide leaching solutions can enter surface water courses, killing fish and contaminating drinking water sources. Or leaching solutions can enter ground water systems and contaminate water supply wells or discharge contaminated ground water into surface water where streams depend on ground water discharge.
- Cyanide in active heap leaching facilities, ponds, and mining wastes may reach water sources through leaks from leach pads or percolation and runoff from waste piles (EPA 1997).

In addition to other mining contaminants such as acid drainage and toxic concentrations of metals and some nonmetals, cyanide contamination can significantly harm aquatic life. Cyanide is toxic in its free forms, hydrogen cyanide (HCN), and the cyanide ion (CN-), and as breakdown compounds such as cyanates, thiocyanates, chloroamines, cyanogen chloride, and metal-cyanide complexes. No contaminant level criteria have been established for cyanide-related compounds (Moran 1998).

Although free cyanide does not persist in the natural environment and does not bioaccumulate through the food chain, some of the breakdown complexes do bioaccumulate, and some are especially toxic to fish. Consequently, both short- and long-term exposure to excessive concentrations of cyanide and related compounds can kill or impair aquatic life (Moran 1998).

Sediments. The impacts from placer mining and general surface disturbance from exploration and mining include increased organic loading in the stream system from the introducing of overburden sediments or inundating of organic-rich soils. This increase may do the following:

- Produce anaerobic conditions in the sediment.
- Decrease dissolved-oxygen levels in the water.
- Increase color, iron, tannin, lignin, organic carbon, nutrients, dissolved solids, and chemical or biological oxygen demand.

Regulatory Environment. The Clean Water Act (CWA) (1977) and the Safe Drinking Water Act (1974, amended in 1986 and 1996) mandate that all states adopt water quality standards, which set forth designated uses of waters within their states and numeric criteria to protect those uses.

Section 304(a) of the CWA requires the U.S. Environmental Protection Agency (EPA) to publish and periodically update ambient water quality criteria. These criteria are to accurately reflect the latest scientific knowledge on the following:

- Kind and extent of all identifiable effects on health and welfare, including plankton, fish, shellfish, wildlife, plant life, shorelines, beaches, aesthetics, and recreation that may be expected from the presence of pollutants in any body of water, including ground water.
- Concentration and dispersal of pollutants or their byproducts through biological, physical, and chemical processes.
- Effects of pollutants on biological community, diversity, productivity, and stability, including information on factors affecting rates of eutrophication and organic and inorganic sedimentation for varying types of receiving waters.

These criteria are not rules, and they do not have any regulatory effect. They are criteria and guidelines that can be used to derive regulatory requirements, based on considerations of water quality impacts. The criteria are published in *Quality Criteria for Water*, often called the "Gold Book" (EPA 1986).

On October 18, 1997, the 25th anniversary of the enactment of the Clean Water Act, the Vice President called for a renewed effort to restore and protect water quality. He asked that the Secretary of Agriculture and the EPA Administrator, working with other affected agencies, develop a Clean Water Action Plan that builds on clean water successes and addresses three major goals:

- Enhanced protection from public health threats posed by water pollution.
- More effective control of polluted runoff.
- Promotion of water quality protection on a watershed basis.

On February 19, 1998, the Clean Water Action Plan was released. It set in motion guidance to the partner federal agencies, directing them to coordinate and implement action items to assess, protect and restore watersheds. The plan consists of 111 action items designed to help improve the Nation's water quality. One action item pertains to active mines and states that: "... federal land management agencies and EPA will forge a partnership, consistent with the watershed-based strategy described [in the plan] ... to help resolve issues and enhance review, planning and operations for active mining operations." (EPA 1998). The plan is not a new regulatory program. Rather, it is a set of goals by which states and the federal agencies can cooperatively improve water quality.

The Safe Drinking Water Act established drinking water regulations, setting maximum contaminant levels (MCLs), which are primary standards, and maximum contaminant level goals (MGLGs) for specific contaminants. Whereas MCLs are mandatory and enforceable standards, MCLGs are secondary standards and as such are nonenforceable (40 CFR Part 141). The National Primary Drinking Water Standards, set forth in 40 CFR Part 142, establish drinking water standards that all states must either adopt or have their own standards that are at least as stringent.

The National Secondary Drinking Water Standards are set forth in 40 CFR 143. Mineral operations must meet all water protection standards that have evolved out of these federal laws.

Protecting ground water is mainly a state responsibility. No federal laws deal specifically with ground water although the latest amendments (1996) to the Safe Drinking Water Act address source water protection areas (SWPA) that provide for protecting ground water sources used for drinking water. States are beginning to implement source water protection programs for areas that supply water for public use. These initiatives may be applied to mining if it is conducted near recharge areas for community water supplies.

State regulatory agencies are paying increased attention to water resource concerns. Many states have enacted environmental protection laws since 1990, and many of these laws have mining provisions. Examples include Arizona's Aquifer Protection Permit program begun in 1994 and 1995 and the Mined Land Reclamation Act passed in 1994, and Colorado's Mined Land Reclamation Act, which was significantly amended in 1996.

The state mining and water laws and regulations are constantly evolving in response to increasing regulatory experience in mining and advancing technology, citizen and legislator concern for environmental issues, and the state anticipation of federal action (McElfish and others 1996). But many states do not have programs in place that mimic the National Environmental Policy Act (NEPA). Environmental regulation is handled through specific state programs, focusing on issues or activities, and are often either reclamation-based or water pollution control programs (McElfish and others 1996).

Federal water protection requirements affect state water resource protection laws. For example, a major piece of legislation in Arizona in 1986 created a broad water resource protection law, which adopted the federal water quality standards as the state standard and provided that other water quality standards might be adopted as deemed needed (Arizona Dept. of Mines and Mineral Resources 1998).

The state and federal water protection requirements are used to ensure that mineral activities comply with all standards for water protection. Federal regulations to protect water resources apply to the production of federally owned minerals. These statutes either (1) focus on monitoring to ensure detection of contaminants at existing operations or (2) are aimed at providing protection measures such as creating aquifer protection areas for municipal drinking water wells by employing a buffer zone that precludes development.

Many states have also enacted ground water classification programs to help make decisions on development and protection of water supplies. Some of these programs are not specific to mining but require the overall protection of ground water from contamination sources.

Two pollution prevention programs focusing on ground water are the Wellhead Protection Program (WHP) created by the Safe Drinking Water Act amendments of 1986, and the Source Water Assessment and Protections Programs created by the Safe Drinking Water Act amendments of 1996.

The wellhead protection program directs the states to protect wellhead areas from contaminants that may harm human health. Protection measures include (1) determining areas around public water supply wells that contribute to ground water and (2) managing potential sources of contamination in these areas to reduce threats to the resource. As of April 1, 1999, a total of 47 states and two territories had developed and implemented EPA-approved well head protection programs, and three states are continuing their efforts to develop such approved programs (EPA 1999a). This program may affect mining, depending on the state approach used.

Under the Source Water Assessment and Protection Program, states have developed programs for delineating source water areas for public water supply systems and assessing the susceptibility of the source water to contamination (EPA 1999a). The applicability of this program to mining could vary, depending on how the state approaches the program.

Environmental Consequences

Alternative 1: No Action

Water Quality.

Pit Lakes. Under No Action, after mining is completed, pit lakes could form and take decades to reach their full depth upon equilibrium with the regional ground water system. The number of new open pit mines in the foreseeable future would likely continue at the same rate as during the past 10 years. Potential impacts to water resources could include the following:

- Migration of contaminated water from the pit lake into aquifers down gradient of the pit.
- Discharge of contaminated ground water to the surface through springs or seeps.
- Mortality of waterfowl landing on pit lakes if the lake water is toxic (acidic or alkaline).
- Increased losses of water by evaporation.

Acid Rock Drainage. Water quality could degrade in some areas from development of acid rock drainage from waste rock piles and tailing impoundments, and flow-through leakage from pit lakes. Acid rock drainage would largely be a problem where water quality analysis has not been accurate or mitigation measures have not been successful in preventing it.

Water Quality Not Related to Acid Rock Drainage. Streams would continue to receive some loading of sediments from disturbed areas. Even best management practices would not eliminate sedimentation. Leachate from waste materials might not be acid rock drainage but might still have high level of metals. This leachate might contaminate soils and water.

Surface Water Diversions. Some surface water courses would be diverted from their natural channels where they pass over or near large mines. Many of these diversions would be temporary during mine operations. Others would be permanent because the stream could not be rerouted to the original channel after establishing a new channel with stream dynamics and vegetation.

Spills. Accidental spills of mineral processing chemicals (cyanide) or catastrophic failure of tailings impoundments or heap leach pads could release toxic chemicals into streams and ground water. Most of these unplanned and undesirable events would be short-term impacts and successfully remediated, but sometimes at a high cost, if long-term remediation is needed. These situations are covered by the Resource Conservation and Recovery Act (RCRA) or the Clean Water Act (CWA) if toxic chemicals are released to water.

Leakage from Tailings Impoundments and Heap Leach Facilities. Tailings impoundments and heap leach facilities are expected to leak. But because most facilities employ either leak detection or monitoring systems, leaks would be discovered and remediated. Detection could fail, and leakage could escape. Some constituents could percolate into the ground water below the impoundment and migrate down gradient to water sources, threatening receptors. Most facilities are monitored for up to 30 years after mine closure.

Ground Water Degradation. Polluted ground water might emerge as nonpoint discharges (diffuse springs and seeps) that might not become evident for years after underground mines have closed (after mine filling). Such discharges might be indicators of a widespread contamination plume migrating from the mine.

Water Quantity. Under No Action, impacts would continue from dewatering. Some springs would be lost. Some streams would dry up. Lowered water levels could require some farms to deepen irrigation wells. Ground water levels would take years, perhaps decades, to fully recover from dewatering at the largest mines. Some water levels might never fully recover to premining levels.

Discharge of Pumpage. Water pumped from dewatering could be discharged into existing stream channels. New riparian areas might be temporarily created during dewatering, altering channel morphology. Some aquifers could contain waters naturally high in some constituents such as arsenic. Discharge of waters containing elevated levels of such constituents could migrate down channel into existing waters that meet standards and lower the quality of the receiving waters.

Cumulative Impacts. Under No Action, cumulative impacts to water resources would result from new open pit mines being developed near existing mines. Such a situation is emerging in northern Nevada, where several open pit gold mines are being developed and new mines are in the EIS or planning phase. Other cumulative impacts could result in areas already affected by past mining. New mines in these areas could further degrade water quality of surface streams. On the other hand, new mineral activity in historically degraded areas could actually improve water quality.

Alternative 2: State Management

States are increasingly using water quality-based effluent limits to set their permitting regulations. Some states require design or performance standards, especially for such things as construction standards and liners for tailings impoundments and heap leach pads.

Under the State Management Alternative, water resource impacts would vary due to the wide variation in state-based regulatory mining programs. Only three western states have their own National Environmental Policy Act (NEPA) laws (NRC 1999). Much of the state regulation of mining is under the state reclamation laws, and all western states have enacted these types of regulations (NRC 1999). Some of the mining regulation comes under the purview of the state water pollution laws. Mining will likely have to comply with an evolving set of state standards and regulations that could become more restrictive if states adopt prescriptive standards. State mining regulations and legislation are constantly being updated, mainly due to three factors:

- Increasing regulatory experience and improvements in technology for monitoring and detection.
- Increasing citizen and legislator concern for the environment.
- State anticipation of federal action in the absence of state regulations (McElfish and others 1996).

The expected slight increase in mineral activity (up to 5%) could slightly increase potential impacts to water resources because of the increased number of mines operating. Some states could have decreased impacts to water, depending on the changes in regulations applied to mining.

Alternative 3: Proposed Action

The Proposed Action would not change the existing framework of federal and state laws that protect water resources but would increase protective measures for water resources and reduce the risk of water resource contamination by doing the following:

- Implementing tighter controls on capturing and treating acid rock drainage.
- Managing potentially acid-forming materials (source controls).
- Drilling and grouting exploration holes.
- Collecting baseline data before operation startup.
- Designing leach operations.
- Monitoring water resources.
- Backfilling pits.

These measures would ensure that water resources would be protected to regulatory standards. Periodically, operations would deviate from the standards and would require time to comply with them.

Predicting water quality impacts at mining sites is difficult and involves much uncertainty. Mitigation measures are designed around the uncertainty inherent in predicting water-rock interactions and implementing environmental controls. These measures would continue to protect water resources.

Water Quality.

Surface Water. The Proposed Action would probably reduce the extent of impacts to water resources from mining. The strengthened provisions for water quality protection would help reduce the potential for water quality degradation. Contamination to surface water courses could decline.

Pit Lakes. Mine pit lakes could affect surface and ground water resources. Backfilling open pit mines would slightly reduce impacts from pit lakes. This provision would analyze backfilling and could reduce the number and the size of pit lakes and their impacts on water quality.

Ground Water. Overall, ground water would be better protected under the Proposed Action than under No Action. The effect of backfilling on ground water quality would be highly variable, depending on the type of deposit mined and the effectiveness of segregating the backfill material to prevent the onset of acid generation if this material includes acid-forming waste rock. Overall, the backfilling requirement would be used to reduce impacts to ground water.

The Proposed Action includes requirements to plug all exploration holes to prevent the mixing of water from different aquifers and to prevent movement of water downward into mine workings. These requirements would likely benefit ground water.

Water Quantity.

Dewatering. Under the Proposed Action impacts would continue from dewatering. Some springs would be lost. Some streams would dry up. Lowered water levels could require some farms to deepen irrigation wells. Ground water levels would take years, perhaps decades, to fully recover from dewatering at the largest mines. Some water levels might never fully recover to premining levels.

Discharge of Pumpage. Pumpage from dewatering could be discharged into existing stream channels. Dewatering might create new riparian areas, resulting in altered channel morphology. Some aquifers could contain waters naturally high in some constituents such as arsenic. Discharge of waters containing elevated levels of such constituents could migrate down channel into existing waters that meet standards and lower the quality of receiving waters.

Cumulative Impacts. The dominant water use in many of the mining regions consists of livestock grazing and agriculture. Livestock grazing has required the developing of springs and shallow wells to supply water for livestock. Agricultural uses include high-capacity irrigation wells that may be affected by cones of depression from mine dewatering. The irrigation uses lower water levels in shallow aquifers, but only locally, and often with seasonal fluctuations. Cumulative water resource impacts of mining would continue to be experienced where several mines are permitted in a region, such as in the Humboldt River Basin in northern Nevada.

The most notable impact would be the effect of coalescing cones of depression from dewatering open pit mines that are close to each other. These effects could extend for a radius of several miles. The discharge of pumpage from dewatering several mines could become a serious water management problem that could be compounded by water quality concerns of the discharged water.

Water discharged into streams can change river channel morphology, inundate or destroy riparian vegetation, and disturb fish habitat. Water discharged into reservoirs can percolate into the shallow ground water system and flow to perennial streams, causing increases in flow. Water temperature can increase if the water is discharged directly into streams, harming fish and benthic aquatic organisms.

Alternative 4: Maximum Protection

Alternative 4 would offer the greatest potential for protecting water quality. The provision that all disturbance greater than casual use would require a Plan of Operations would help determine activities that could affect water resources. The use of minimum national design standards for exploration, mining, and reclamation would decrease impacts to water resources. But these standards would increase costs to the industry and increase the workload for the agency in designing standards. Difficulty could arise in implementing some common standards across the West.

The decrease in mineral activity, the more stringent standards, and the unsuitability requirements would all reduce potential adverse impacts to water resources. The requirement of designing all facilities to meet the probable maximum precipitation event could result in decreasing the amount of erosion and sediment from the facility and containing any spills or unplanned events. The requirement that Plans of Operation be renewed every 5 years could help find potential water resource problem areas. Bonding requirements to cover spills and other unplanned events or facility failures could provide a means to mitigate impacts to water resources.

Water Quality.

Pit Lakes. Requirements for pit backfilling would improve water quality at some mines. Eliminating pit lakes would decrease potential impacts to waterfowl if lake water is toxic to such species.

Acid Rock Drainage. Evaluation and control measures for acid rock drainage would strengthen protection for water resources. Restricting operations to no more than 20 years of water treatment would result in applying source control measures to minimize water contamination. As a result, any treatment facilities that might be required as a last resort under Alternative 4 could be built at a smaller scale than under other alternatives.

Water Quantity. The requirement for operators to restore the hydrologic balance within 20 years would prevent long-term impacts to water resources.

Alternative 5: NRC Recommendations

Alternative 5 would generally protect water resources slightly better than would the existing regulations because of the following provisions:

- Exploration in existing special status lands or where more than 5 acres are disturbed would require a Plan of Operations. A Plan would address any water quality or quantity problems that need to be mitigated, and design features would be added to avoid unnecessary or undue degradation of the environment.
- Project approvals would establish acceptable postclosure water quality conditions for pit lakes suitable for long-term use of the site and adequately protecting affected ground and surface waters, as well as wildlife and waterfowl.

Impacts to water resources from acid-forming materials could increase under Alternative 5 because it does not require static or kinetic testing of rock to help recognize and guide the placement of potentially acid-forming materials.

Water resources would be protected in an incremental amount over the existing regulations (Alternative 1).

Soils

Affected Environment

The National Research Council (1981) defines soil as a discrete, definable, dynamic complex of organic, inorganic, biologic, and geologic materials. Soil forms slowly, beginning with the accumulation of unproductive materials and increasing in productivity with the natural processes of weathering, biological activity, and leaching. Soil's ability to support life depends on its capacity to absorb, store, and transfer energy and water.

Brady (1974) outlined five major soil forming processes as (1) climate, (2) living organisms, (3) parent material, (4) topography, and (5) time. As the soil weathers, a soil profile forms. A profile consists of layers or horizontal units called horizons. These soil horizons can be grouped into four general zones: the O, A, B, and C horizons (Brady 1974).

- The O horizon consists of organic-rich horizons formed above mineral soil, resulting from litter derived from dead plants and animals.
- The A horizon consists of mineral horizons that lie at or near the surface and are zones of maximum leaching or eluviation.
- The B horizon, sometimes referred to as the subsoil, consists of horizons in which illuviation (deposition from one horizon to another) from above contributes to an accumulation of such materials as iron and aluminum oxides and silicate clays, or in arid regions, accumulations of calcium carbonates or calcium sulfate.
- The C horizon consists of the unconsolidated material underlying the A and B horizons and may or may not be the same as the parent from which the A and B horizons formed. The C horizon usually lies outside the zones of major biological activity and is little affected by soil-forming processes.

A soil profile is characterized by the sequence and development of the horizons described above. These horizons normally can be distinguished from one another by their texture, color, structure, and organic matter content. Under the Comprehensive Soil Survey System, the soil profile can be classified into one of 10 broad classifications called soil orders (Brady 1974). Within the EIS study area are 10 major soil orders: Andisols, Aridisols, Entisols, Inceptisols, Mollisols, Ultisols, Alfisols, Histosols, and Spodosols.

- **Andisols** formed under the strong influence of volcanic ash. They are often erosive and found mostly in forested areas.
- **Aridisols** developed in dry regions and are usually light colored and low in organic matter. They may have accumulations of sodium, soluble salts, and lime. Desert shrubs, sagebrush, and pinyon-juniper plant communities commonly grow on Aridisols.
- **Entisols** are relatively young soils formed in recently deposited materials. They therefore have little soil profile development.

- **Inceptisols** are also young soils that have undergone more weathering and soil-forming processes than Entisols. Inceptisols are common in coniferous and deciduous forests.
- **Mollisols** have a thick, dark colored surface horizon rich in organic matter and are most abundant in prairie grasslands.
- **Ultisols** occur on stable surfaces that have undergone advanced soil development resulting in the accumulation of a clay-rich subsurface horizon. Ultisols are usually found in forests.
- **Alfisols** also exhibit clay accumulation within the soil profile and are most common in coniferous and deciduous forests at higher elevations and in mountain shrub communities.
- **Histosols** contain at least 50% organic matter in the upper 32 inches of their profile and occur within riparian areas, seeps, and bogs.
- **Spodosols** are mineral soils with a subsurface horizon having an accumulation of organic matter. Spodosols are common along coastal areas of Alaska and support Sitka spruce and western hemlock.

Since the inception of the 3809 regulations in 1981, exploration and mining have disturbed about 214,000 acres of public lands, including the soils on them. Except for placer mining, most of this disturbance has taken place within the western contiguous states, predominantly on Aridisols and Mollisols. The bulk of placer mining on public lands has occurred in stream channels in Alaska, disturbing mainly Entisols. Of the 214,000 acres disturbed by mining under the 3809 regulations, 65,000 acres have been reclaimed. The remaining 149,000 acres yet to be reclaimed are still part of active mining operations and, except for open pits not backfilled, will eventually be reclaimed.

Reclamation in the early 1980s consisted mainly of grading to gentler slopes followed occasionally by seeding. Attempts at salvaging topsoil were inconsistent. Disturbed areas were often revegetated directly on the regraded surfaces of waste rock, tailings, or heap leach material. Through the mid-1980s, as larger mines were proposed, it became a more common practice to conduct soil surveys and salvage the soil surface–the O and the A horizons–commonly known as topsoil, for later use on the reconstructed surfaces.

Between 6 inches and 2 feet of topsoil are typically salvaged except where bedrock is close to the surface or surface accumulations of salts or sodium inhibit plant growth. Where topsoil is lacking or unsuitable, reclamation is still undertaken directly on the reconstructed surfaces. Soil amendments such as mulch and fertilizer may be used to minimize erosion and improve the fertility of the reconstructed surfaces for vegetation. Reclamation plans generally address issues involving postmining physical and chemical characteristics of the soils on particular sites.

For placer mining, the surface layer of soil, where it exists in enough quantity, is usually stripped and used later for reclamation. But the bulk of placer mining on public lands has taken place within Alaska, and many of these areas have been already mined in the past. Soils that may have been there have since been mined through and lost. Larger placer mines are usually reclaimed by regrading tailings and coarse rock stockpiles to re-create the channel and flood plain. Vegetation is then allowed to become established by natural succession. Placer mining usually occurs within the confines of a drainage system. Over time, especially during high flows, the drainage reworks the loose material and establishes a new floodplain.

As the reclamation program for the 3809 regulations has evolved, many western states also began to institute mine reclamation programs of their own, on private as well as the public lands. (See Appendix D for a summary of state mine reclamation programs.) Many of these state reclamation programs were developed at about the same time as the existing 3809 regulations, and they often mirrored and reemphasized BLM's reclamation programs.

Environmental Consequences

Impacts Common to All Alternatives

Mining typically follows a logical sequence, starting with exploration and proceeding to extraction when economic deposits are found. Impacts of this sequence on soils range from dispersed and negligible during early exploration to more local and intense as mineralization and ore deposits are defined and mined.

With mining, disturbance is nearly total as the soil profile is destroyed either by excavation or burial. The National Research Council (1981) summarized the effects of soil disturbance by mining as generally more adverse than advantageous because many beneficial soil characteristics require hundreds to tens of thousands of years to reach steady state.

Disturbance, however, may actually increase a soil's productivity where mining breaks up a restrictive hardpan or where replacement of sodium or salt-affected soils results in greater plant growth (National Research Council 1981; Schafer 1984).

Because only the topsoil is usually salvaged and stockpiled for later reclamation, the loss of the rest of the soil profile is almost always irreversible, including, whatever forces these deeper horizons played in favoring the growth of one plant over another or one plant community over another.

Reclamation of mine disturbances, either concurrent with mining or after closure, customarily involves grading slopes to less steep angles, applying topsoil, and revegetating. Except for open pit mining, most mining disturbances can be reclaimed to vegetation that is adapted to the reconstructed surface and new soil regime. Most often, however, the newly reconstructed soil would resemble a younger soil, such as an Entisol, with little soil profile development.

Alternative 1: No Action

Under the existing 3809 regulations topsoil is salvaged and stockpiled for reclamation use later. Upon final reclamation, slopes are usually graded to blend with the surrounding topography, topsoil is reapplied, and new surfaces are seeded. The main emphasis of this reclamation has been on establishing a productive cover of perennial plants roughly equal to what exists next to the mine disturbance. To this end, mine reclamation has been fairly successful (Ross 1996). In Alaska, vegetation cover is generally allowed to come back naturally following grading and reapplying topsoil.

The exceptions to the salvaging of topsoil occur under the following conditions:

- The soil has been lost due to past mining.
- Little soil exists to strip because of thinness to bedrock or a hardpan.
- The surface has chemical or physical properties that inhibit plant growth.

In these latter cases, materials (waste rock, tailings, or heap leach material) left on the surface after regrading are reclaimed. Problems may occur, however, where the reconstructed surfaces of waste rock, tailings, or heap leach material are also harmful to or unsuitable for plant growth for physical and chemical reasons. Soil amendments such as mulch and fertilizer may be added to improve the fertility of the new surface. But the new soil might not be able to support the same plants or diversity of plants as before.

Alternative 2: State Management

Except for small disturbances, all the states in the study area have some form of program in place for reclaiming mining disturbance. For activities involving less than 3 to 5 acres of surface disturbance, states like Arizona, Alaska, Montana, Nevada, and Washington do not require operators to notify state authorities of surface-disturbance or reclamation, even though reclamation is required. Without oversite, some of these small-sized projects would not receive the same level of reclamation as they might under the existing regulations where notification is required.

State requirements for salvaging and reapplying topsoil upon reclamation are similar to BLM's existing 3809 regulations, but state agencies are usually staffed at much lower levels and may lack their federal counterpart's resources in administering the mine reclamation program. State agencies are usually located in one central place in contrast to BLM, which has field offices spread throughout the state nearer the mining activities and public lands they manage. BLM offices also have reclamation specialists and soil scientists whose expertise would ensure that soil resources are salvaged for final reclamation. Because of the state's reduced oversite, less topsoil may be salvaged by the operator or safely stockpiled from the impacts of future mine disturbance under Alternative 2 under BLM management under the existing regulations or proposed alternatives.

Alternative 3: Proposed Action

The Proposed Action requires the use of replacement soil where the topsoil is of poor quality. Under the existing regulations, typically only the surface horizons or topsoil is salvaged and stockpiled for reclamation use. In most cases, the topsoil provides the most desirable growth medium for plant growth. But in some cases the topsoil itself is harmful to plant growth because of accumulations of salt or sodium, or where the volume of topsoil itself may be limited because of shallow depth to bedrock or a hardpan. In these cases, salvaging and stockpiling overburden or waste rock with desirable characteristics for replacement growth medium would promote better revegetation than under the existing regulations.

Mining can lead to accelerated soil erosion, where the surface is disturbed and vegetation has been disturbed or removed. The Proposed Action requires that erosion be minimized through grading of reclaimed slopes to gentler contours followed by revegetation to hold the soil in place. This requirement should lead to less soil erosion than under the existing regulations, Alternative 2, or Alternative 5.

Under the Proposed Action, all mining projects would require Plans of Operations, resulting in a more formal review and approval of activities. This review and approval would ensure that more soil is salvaged and conserved for final reclamation than under the existing regulations.

The Proposed Action would require reclamation bonds for all Notices. This financial assurance would prompt better compliance by the operator with reclamation measures than under the existing regulations, including the salvaging and stockpiling of topsoil and its use in final reclamation of the site.

Alternative 4: Maximum Protection

Alternative 4 would require that subsurface horizons as well as the soil surface be salvaged and stockpiled. Compared to the other alternatives, this requirement to salvage more of the soil profile and return it near its original vertical order on the reconstructed surface would promote easier restoration of the site to the same native plants and plant community that grew there before mining.

Alternative 4 would also require that all operations have Plans of Operations, resulting in a more formal review and approval of activities. This review and approval would ensure that more soil is salvaged and conserved for final reclamation. Alternative 4 would also require operators to hire third-party contractors to monitor operations, and this greater on-the-ground presence of monitors would ensure that the proper depth and volumes of soil are salvaged and stockpiled according to the reclamation plan.

Alternative 4 would require that all final slopes be graded to 3 to 1 (horizontal to vertical). This requirement would result in less soil erosion than any other alternative and would facilitate better revegetation. The standard, however, would be impossible to apply where the natural terrain is steeper than 3:1, which is common where mining occurs.

Alternative 5: NRC Recommendations

Under Alternative 5 all mining projects would require Plans of Operations, resulting in a more formal review and approval of activities and ensuring that more soil is salvaged and conserved for final reclamation than under the existing regulations. The requirement for the bonding of all Notice-level operations would also give more assurance that disturbed areas are reclaimed than could be given by the existing regulations or Alternative 2.

Alternative 5 would require reclamation bonds for all Notice-level operations. Compared to the existing regulations, this financial assurance would prompt better compliance by the operator with reclamation measures, including, the salvaging and stockpiling of topsoil and its use in reclaiming the site

Cumulative and Residual Impacts to Soil Resources

An estimated 214,000 acres of public lands were disturbed by exploration and mining in the first 18 years after the 3809 regulations went into effect in 1981. Projections for mineral activities over the next 20 years show that surface disturbance under the existing regulations and alternatives would disturb as much as 183,000 more acres. The total surface disturbance on soil resources from past and reasonable foreseeable mineral activities over 20 years, therefore, would equal as much as 400,000 acres. This amounts represents about 0.12% of the total acreage of public lands and Stock Raising Homestead Act lands administered by the BLM within the study area (see Table 3-1). The cumulative impact from mining activities on soil resources within the study area is therefore rather limited.

The 400,000 acres disturbed by mining would undergo long-lasting residual impacts. Even though most of this disturbance would eventually be reclaimed, mining destroys the original soil profile by excavation or burial. A soil profile ordinarily requires hundreds to tens of thousands of years to develop. Because only the surface or topsoil is usually salvaged, the loss of the remaining profile constitutes a near irreversible commitment of these soil resources. Alternative 4 would require more of the soil profile to be salvaged, resulting in less of a commitment of these soil resources then the other alternatives.

Typically, topsoil is stockpiled for long periods in open-pit operations and begins to lose fertility. Due to a lack of oxygen, soils buried under a few feet would begin to lose the microfauna and flora that are important in nutrient cycling. At the same time, seeds stored in the buried topsoil also begin to lose their viability, and the benefits of the soil as a native seedbank are diminished.

Once reclamation is completed, however, any micro-fauna and flora still viable in the topsoil would begin to spread or volunteer from outside onto the site. Conceivably, within a few years to decades, the surface soil should begin to approach the surrounding, undisturbed areas in organic matter content and presence of microfauna and flora. If left undisturbed, cryptogamic crusts might also begin to reestablish within the same time frames.

Vegetation

Affected Environment

The pattern of vegetation in North America has fluctuated widely in the past 10,000 to 12,000 years, following the melting of the continental glaciers. During the postglacial period the climate was notably warmer and drier than today. The boundaries of the forests and shrub-like grasslands have fluctuated accordingly (Mehringer and Wigand 1987), as have the boundaries of other drier-site plant communities. Still, the types of plant communities that will grow on a site are dictated most often by the site's soil type, its topographic position, and the area's climate.

Plant community types within the EIS study area can be divided into the following broad groups: sagebrush, desert shrub, southwest shrubsteppe, chaparral-mountain shrub, pinyon-juniper, mountain and plateau grasslands, plains grasslands, annual grasslands, alpine grasslands, coniferous and deciduous forests, riparian communities, coastal forests, boreal forests, lowland tundra, and upland tundra. This section briefly discusses all of these groups except for riparian communities, which are discussed in the Riparian-Wetland Resources section of this chapter. For a more complete description of most of these plant community types, see the *Rangeland Reform '94 Draft EIS* (BLM 1994a).

Sagebrush

Within the upper and lower basin and range provinces, the Colorado Plateau, the Columbia Plateau, and the Wyoming basins, sagebrush often dominates dry slopes and lava bed flats, ancient lakebeds, and broad alluvial basins. Most of the sagebrush zone is found at elevations from 2,000 to 7,000 feet. Where sagebrush dominates below 7,000 feet, annual precipitation varies between 8 and 20 inches (Wright and others 1979).

Important shrubs include big sagebrush, black sagebrush, low sagebrush, rabbitbrush, Mormon tea, curly leaf mountain mahogany, bitterbrush, snowberry, and horsebrush. Important perennial grasses include Sandberg bluegrass, blue bunch wheatgrass, western wheatgrass, Idaho fescue, Great Basin wildrye, junegrass, Indian ricegrass, squirreltail, muttongrass, and needle-and-thread grass. Red brome, medusahead, and cheatgrass are introduced annual grasses that have become abundant. Common forbs include wild onion, sego lily, balsam root, mulesear, Indian paintbrush, larkspur, tarweed, rubberweed, lupine, phlox, locoweed, and annual mustards (Cronquist and others 1972).

Desert Shrub

Desert shrub communities occupy the hot and cold deserts of Arizona, Nevada, Utah, and California. These deserts are dominated by shrubs in open stands, with large amounts of bare soil or desert pavement exposed. Understory vegetation is often sparse at lower elevations except when flushes of annuals are produced by seasonal precipitation in the Mojave and Sonoran deserts.

Desert plants have adapted to harsh growing conditions, which include root systems of some shrubs that can access deep soil moisture, as well as, shallow roots that extend laterally some distance and compete with herbaceous vegetation for surface moisture. Plants such as cacti and other succulents have special tissue in their stems or leaves to store moisture and limit moisture losses by minimizing transpiration. Annuals germinate, mature, and produce seeds only during favorable temperatures and moisture conditions, often within a single season. Desert plants have also adapted to drought caused by high soil salinity or alkalinity by removing excess salts from their tissues and regulating salt uptake from their roots.

Southwest Shrubsteppe

The southwest shrubsteppe vegetation zone occupies the semidesert grasslands of southeast Arizona, southern New Mexico and the northern Chihuahuan Desert. Elevations of the semidesert grasslands range from 3,300 to 5,000 feet (Brown 1985). More than half of the 10 to 20 inches of annual precipitation falls during the summer growing season (Benson and Darrow 1981). Semidesert grasslands are best developed on deep, well-drained soils at level sites on the higher plains. Their aspect is a grassy landscape broken up by large, well-spaced shrubs. In the Southwest, semiarid grasslands often form an alternating landscape mosaic with Chihuahuan desertscrub.

Large areas of this grassland are dominated by mesquite, tarbush, acacia, and creosotebush. Black grama and tobosa are the most characteristic grasses. Other important grasses on the better sites include sideoats grama, hairy grama, bush muhly, vine mesquite, Arizona cottontop, slim tridens, pappus grass, tanglehead, threeawns and curly mesquite. Other shrubs and succulents characteristic of this grassland include yuccas, bear grass, sotol, agaves, allthorn, sumac, hackberry, ocotillo, acacias, and mimosas. Many variations of cacti grow in the drier sites, especially on outcrops.

Chaparral-Mountain Shrub

The chaparral-mountain shrub vegetation type occupies foothills, mountain slopes, and canyon habitats ranging from southern Oregon to the Mexican border, and from sea level to more than 5,000 feet. Chaparral-mountain shrub communities typically consist of dense to moderately opens stands of evergreen shrubs that grow to roughly uniform height. Most chaparral shrubs are deep rooted, sprout readily from the root crown, and regenerate quickly after burning (Brown 1982).

Canyon live oak is a common dominant of the interior chaparral. Associated shrubs include manzanita; mountain mahogany; yellowleaf silktassel; sumac; hollyleaf buckthorn; chamise; red shank; and several sophora, ceanothus, and other oak species. Important grasses include sideoats and hairy grama, cane bluestem, plains lovegrass, threeawns, and wolftail. These grasses are largely confined to recently burned areas and rocky, protected sites. Forbs are not particularly abundant except during brief periods after burns (Brown 1982).

Pinyon-Juniper

The pinyon pine and juniper vegetation type grows at mid-elevations on mountain slopes within and next to the Great Basin. This is a cold-adapted evergreen woodland with the unequal dominance of two conifers, junipers and pinyon pine. The pinyon-juniper woodland reaches its greatest development on mesas, plateaus, slopes, and ridges from 3,200 to 8,400 feet (Blackburn and Tueller 1970; Evans 1988). Precipitation ranges from 10 to 25 inches annually (Blackburn and Tueller 1970). Pinyon-juniper communities survive on a wide variety of soils, ranging from shallow to moderately deep and from coarse and rocky to fine compacted clays.

Rocky Mountain juniper, Utah juniper, and oneseed juniper often grow together (Cronquist and others 1972). In the dry mountains of southern New Mexico and below the Mogollon Rim in Arizona, Rocky Mountain juniper, Utah juniper, and doubleleaf juniper disappear, and alligator juniper (a sprouting variation of juniper), Emory oak, gray oak, and Mexican pinyon appear (Brown 1982). The associated understory of shrubs, grasses, and forbs in juniper communities commonly consists of a variety of vegetation from sites near woodland communities.

Mountain and Plateau Grasslands

The mountain and plateau grasslands are located at moderate to high elevations (3,000 to more than 9,000 feet) in the West. These grasslands often occur within a vegetation mosaic created by the complex environment of the Rocky Mountains. The grasslands ecosystem receives from 8 to 30 inches of precipitation annually (Garrison and others 1977; Mueggler and Stewart 1980), at least half of it usually falling during the growing season. The topography of mountain and plateau grasslands ranges from level areas or valley floors to alluvial benches and foothills or steep mountain slopes.

Important grasses in mountain and plateau grasslands include grama grasses, bromes, bluegrasses, oatgrasses, sedges, wheatgrasses, fescues, needlegrasses, and Junegrass. Diverse throughout the region, the forb component varies with the site, latitude, and management. Shrubs include fringed sagebrush, rabbitbrushes, snakeweed, shrubby cinquefoils, wild roses, and horsebrush (Mueggler and Stewart 1980).

Plains Grasslands

The plains grasslands vegetation type is found in the Great Plains, stretching from eastern Montana, North Dakota, and Western Minnesota southward to eastern New Mexico and Texas. The western half of the plains grassland forms a broad, flat belt of land sloping gradually eastward from the foothills of the Rocky Mountains. Mixed and shortgrass communities are most commonly found on federal lands within this vegetation type.

The short grasslands communities stretch from southeast New Mexico through eastern Colorado to southeast Wyoming. Annual precipitation ranges from 11 to 20 inches, and elevations range from 6,000 feet on the western edge to 3,000 feet on the southern edge. Dominant grasses are buffalograss and blue grama, with smaller amounts of threeawns, lovegrass, tridens, sand dropseed, sideoats grama, tobosa, galleta, vine mesquite, and bush muhly. Forbs are seldom a major component, except during wet years. Dominant woody plants include honey mesquite, shinnery oak, sand sagebrush, snakeweed, yucca, fourwing saltbush, cholla, and prickly pear.

The mixed grass communities stretch from northeast Wyoming through North and South Dakota and eastern Montana. Precipitation varies from 20 to 28 inches, increasing from west to east. Elevation ranges from about 3,000 feet at the western edge to 900 feet in Texas (Wright and Bailey 1980). Sedges and cool-season grasses, such as needlegrasses, wheatgrasses, and fescues, dominate the communities of Montana and North and South Dakota. Warm-season grasses, particularly blue grama, also grow in mixed grass communities and increase in dominance to the south.

Other important grasses in mixed grass communities include green needlegrass, prairie sandreed, needle-and-thread grass, junegrass, sand dropseed, buffalograss, sideoats grama, threeawns, silver beardgrass, sand bluestem, little bluestem, plains lovegrass, and vine mesquite (Brown 1982). Shrubs found in mixed grass communities include juniper, sand sagebrush, silver buffaloberry, sumac, wild rose, rabbitbrushes, yucca, snakeweed, cholla, and winterfat (Brown 1982; Mueggler and Stewart 1980). Forbs may be an important component of mixed grass communities. Common forbs include goldeneye, groundsel, sunflowers, primrose, globemallow, asters, scurf pea, coneflower, and bricklebush (Brown 1982).

Annual Grasslands

Annual grasslands occur in California, especially, on small plains and gently rolling hills scattered throughout southern California, the Central Valley, and in the coastal mountains as far north as Humboldt County. Annual grasslands grow at elevations ranging from sea level to 4,000 feet. Relicts of the pristine California prairies are found within small parcels of annual grasslands.

Fall rains cause the germination of the annual grassland plants that grow slowly during winter and then grow rapidly in the spring as temperatures rise. Dominating annual grasslands are such introduced annual grasses as wild oats, soft chess, ripgut brome, red brome, wild barley, and foxtail fescue. Common forbs include redstem filaree, broadstem filaree, turkey mullen, true clovers, and burr clover. Perennial grasses that are found in moist, lightly grazed or relict areas include Idaho fescue and purple needlegrass.

Alpine Grasslands

Beginning at the upper limits of tree growth, alpine plant communities extend upward to the exposed rocks of mountain tops. Alpine communities have similar combinations of vegetation throughout, including, phlox, clovers, alpine avens, yarrow, alpine sedge, alpine bluegrass, elk sedge, spikerush, and tufted hairgrass. The willow communities typically consist of alpine willow, barren ground willow. Tealeaf willow, and snow willow. Alpine meadow communities grow on sheltered benches, slopes, and level areas where soils are well developed. Alpine marshes replace ponds or develop wherever springs and melting snowbanks contribute to a continuously moist habitat.

Coniferous and Deciduous Forests

Coniferous and deciduous forests grow in the Rocky Mountains; the Sierra Nevada; the Cascade Range; and the mountains of the upper and lower basin and range provinces, the Colorado Plateau, and the Columbia Plateau. Species dominance varies by altitude, latitude, slope, aspect or other topographical position, soil characteristics, and climate regime. Important forest communities of the western rangelands include ponderosa pine, Douglas-fir, aspen, lodgepole pine, hemlock-spruce, cedar-hemlock, spruce-fir, redwood, and western hardwood.

Ponderosa pine is the largest western forest, and old-growth ponderosa forests are often park- like, having old trees interspersed within groups of young trees and a well-developed herbaceous understory. Douglas-fir communities are found from the northern portion of the California Coast Range, through Oregon and Washington, and throughout the Rocky Mountains, generally between the ponderosa pine and spruce-fir communities (Wright and Bailey 1982).

Cedar-hemlock forests grow in northern Idaho and northwest Montana, where the westerly winds carry oceanic influence as far inland as the Continental Divide. Douglas-fir and western white pine are common associates. Understory in this zone consists of a rich growth of shrubs and herbs (Wright and Bailey 1982).

Hemlock-spruce communities extend south from British Columbia along the Washington and Oregon coasts and a portion of the Cascade Mountains in Washington. Elevations range from 200 to 4,000 feet. The dominant species are Sitka spruce and western hemlock. Western red cedar, Douglas-fir, and grand fir may also be present to a lesser degree. Common understory plants include vine maple, red whortleberry, Cascades mohonia, twin flower, California dewberry, coast rhododendron, holly fern, and cutleaf fern. The dense overstory reduces production.

Lodgepole pine grows mainly in the central and northern Rocky Mountain of Colorado, Wyoming, Montana, Utah, Idaho, and Oregon. It is also found in the higher mountains of southern California. Lodgepole pine tends to dominate its communities, often forming dense, pure stands with little understory. The understory can vary from being virtually absent to a rich herbaceous layer next to meadow edges. Often invading riparian habitats, lodgepole pine can have a substantial understory of bitterbrush, Idaho fescue, needlegrass, oatgrass, and wildryes.

The spruce-fir community has open to dense evergreen forests and patches of shrubby undergrowth with scattered herbs. Composition of the overstory varies widely but is usually dominated by some combination of red fir, Engelmann spruce, subalpine fir, mountain hemlock, white bark pine, western white pine, lodgepole pine, foxtail pine, limber pine, and bristlecone pine.

The redwood community is a composite name for a variety of mixed conifers that grow within the coastal influence: Sitka spruce, grand fir, redwood, Douglas-fir, and red alder. The redwood community is restricted to the coastal areas of California and southern Oregon.

Western hardwood communities, sometimes called oak woodlands, grow in California and the western interior valleys of Oregon, especially the foothills surrounding the Central Valley and coastal rangelands in California and the Willamette, Umpqua, and Rogue River valleys in Oregon. Trees in these communities include Oregon white oak, Coulter pine, digger pine, coast live oak, blue oak, valley oak, and interior live oak.

Coastal Forests

Coastal forests occupy the south and southeast coasts of Alaska and are dominated by closed and open evergreen forests, mainly Sitka spruce-western hemlock. Closed and open deciduous forest are rare and limited mainly to stands of black cottonwood or red alder on floodplains, streamsides, and recently disturbed sites. Woodland lodgepole pine communities grade into bog types on poorly drained sites. On coastal deltas extensive areas of sedge and grass wet meadows are common (Viereck and others 1992).

Boreal Forests

Occupying vast areas of interior Alaska, boreal forests are dominated by closed, open, and woodland evergreen forest of black and white spruce, but have extensive areas of open and closed deciduous forest of paper birch, aspen, and balsam poplar. Within this vegetation zone are extensive mosaics of shrub and herbaceous types, including extensive areas of subarctic lowland sedge and sedge-moss bog meadows as well as willow, sweetgale, and graminoid bogs (Viereck and others 1992).

Lowland Tundra

The dominant vegetation of the lowland tundra consists of wet sedge meadow interspersed with many lakes. The lowland tundra occurs mainly on the coastal plain of northern Alaska and in the low lying deltas and other coastal areas in western Alaska (Viereck and others 1992).

Upland Tundra

Over much of arctic and western Alaska the upland tundra is dominated by *Eriophorum vaginatum* tundra with areas of *Dryas* dwarf shrub tundra on exposed ridges and dry rocky sites. In mountainous areas above treeline, *Dryas* dwarf and ericaceous shrub tundra are the most widespread plant communities. In many areas in western Alaska and in most areas near treeline in the Alaska and Brooks ranges, the zone includes extensive areas of shrubland, mainly low shrub dwarf birch. On the Aleutian Islands, the most widespread community is *Empetrum* heath, but extensive areas of dry and mesic graminoid herbaceous vegetation also occurs (Viereck and others 1992).

Threatened, Endangered, and Candidate Plant Species

The Endangered Species Act of 1973 was passed to conserve threatened and endangered species and the ecosystems on which they depend (see Appendix C). Under the act, species are classed as threatened, endangered, proposed, or candidate species. Endangered plant species are listed because they are in danger of extinction throughout all or a significant portion of their range. Threatened species are those likely to become endangered within the foreseeable future throughout all or a significant portion of their range. Proposed species are those for which a proposed rule to list as endangered or threatened has been published in the Federal Register. Candidate plant species are on file with the U.S. Fish and Wildlife Service as vulnerable but where further action is precluded by higher priority listing. To date, about 129 plants are listed as federally endangered or threatened plant species on BLM administered lands (see Appendix F).

Impacts of Mining

The 43 CFR 3809 regulations first took effect in 1981. From 1981 through 1998, mineral exploration and mining disturbed 214,000 acres. Except for placer mining, much of this land has been disturbed within the western contiguous states, mostly in the sagebrush, mountain grasslands, pinyon-juniper, prairie grasslands, and southwestern shrubsteppe plant community types. Miners have extracted placer deposits on public lands predominantly within stream channels in Alaska, disturbing mainly riparian vegetation (discussed in the Riparian-Wetland Resources section of this EIS).

Many plant communities disturbed by mining under the existing regulations were within historic mining districts that had themselves been affected by past mining in addition to other activities such as livestock grazing and range seedings. As a result of these past disturbances, weeds have invaded many areas.

Of the 214,000 acres disturbed under the 3809 regulations, 65,000 acres have been reclaimed so far. Except for unbackfilled open pits, the remaining acreage will eventually be reclaimed as these active operations reach closure. Reclamation under the existing regulations has evolved since 1981 as the experience and knowledge of operators and BLM have grown. At the same time, many western states have developed mine reclamation programs in coordination with BLM.

In the early 1980s reclamation consisted of limited grading followed occasionally by seeding. Disturbed areas were often revegetated directly on regraded surfaces of waste rock, tailings, or heap leach material. Beginning in the mid-1980s seeding became a more common practice. It is standard practice now to salvage topsoil and seed disturbed areas.

Operators conducted early seedings using a diverse seed mix upon final reclamation. Early seedings consisted mostly of grasses developed for livestock grazing and known for their drought tolerance and success in establishing itself under a variety of circumstances. Grasses such as crested wheatgrass *(Agropyron cristatum)* were extensively used because seed could be obtained in commercial quantities, established easily, and stabilized disturbed areas. This practice more recently has shifted to seedings using a diverse mixture of native grasses, forbs, and shrubs.

Over the last several years BLM has incorporated more rigorous requirements for monitoring revegetation success, as in Nevada where the perennial plant cover of reclaimed areas is compared to adjacent, undisturbed reference areas. Ross (1996) evaluated the reclamation success of mine disturbances on public lands in Nevada and found that in most cases total perennial plant cover of reclaimed areas equaled and often exceeded the cover of adjacent undisturbed reference areas.

Environmental Consequences

Impacts Common to All Alternatives

Most mine disturbance has and is expected to continue to take place on public lands within Nevada, Montana, California, Arizona, Idaho, Utah, and Alaska, and would affect the sagebrush, desert shrub, pinyon-juniper, and southwest shrubsteppe plant communities. Little mining has or is expected to occur on public lands within coniferous and deciduous forests

Except for open pits and arctic, alpine, and desert environments, which are among the most fragile and slowest to recover from disturbance, most mining disturbances can be reclaimed to vegetation that is adapted to the reconstructed surface and new soil regime.

Upon final reclamation, the classic view of ecological succession holds that a series of plant assemblages will progressively occupy a site following a disturbance. Each plant assemblage is then replaced by a successor until the final climax community is reestablished. Where the goal has been to restore the predisturbance ecosystem, a typical management strategy is to hasten the rate of succession by planting late seral species in the hope that the vegetation will continue quickly toward the premining plant community. The plant community that does establish on the reconstructed surface may well approximate the plants that grew there before. Chances are, however, the site will greatly differ from premining conditions, and a different plant community or potential will become established.

Drastic disturbances such as mining may yield substrates that dramatically differ from those before disturbance. Such differences may affect the rate of succession, chronically altering its direction (Schafer 1984). Different trajectories of succession are therefore possible because of different initial conditions relative to premining conditions following reconstruction and reclamation (Allen 1988). For example, in Nevada shallow-rooted low sagebrush *(Artemisia arbuscula)*, which grows on sites with shallow soils to bedrock or hardpan, would give way to big sagebrush *(Artemisia tridentata)*, where the reconstructed surface now consists of topsoil over a reclaimed waste rock dump. (See the previous discussion on soils.)

BLM must consult with the Fish and Wildlife Service when any mining it authorizes might (1) affect a listed species or its designated critical habitat, or (2) is likely to jeopardize proposed species or adversely modify its proposed critical habitat. The effects of mining are weighed against biological and environmental considerations specific to these species. If the net effect is so damaging to the species that the action is likely to jeopardize the species' existence in the wild or adversely modify critical habitat designated for it, the Fish and Wildlife Services renders a "jeopardy" or "adverse modification" opinion. The Fish and Wildlife Service and BLM then seek alternatives or project modifications that relieve such jeopardy or adverse modification.

Alternative 1: No Action

Under the existing regulations, revegetation is expected to continue to evolve toward a greater use of native species with a more equal composition of forbs, shrubs, and trees relative to grasses. The existing regulations would continue to emphasize surface stabilization and erosion control over establishing preexisting plant communities.

Alternative 2: State Management

Except for small disturbances, all the states in the study area have some form of program in place for reclaiming mining disturbance. For activities involving less than 3 to 5 acres of surface disturbance, states like Arizona, Alaska, Montana, Nevada, and Washington do not require operators to notify state authorities of surface-disturbing activities or reclamation. Even though reclamation is required, without oversite, some of these small projects would not receive the same level of revegetation as they might under the existing regulations where notification is required.

State requirements for revegetation are similar to BLM's existing 3809 regulations, but state agencies in general are usually staffed at much lower levels and lack their federal counterpart's resources in administering the mine reclamation program. State agencies are usually located in one central place in contrast to BLM, which has field offices spread throughout the state nearer the mining activities and public lands they manage. BLM offices also have reclamation specialists, soil scientists, wildlife biologists, and range conservationists whose expertise and advice would help to ensure that revegetation consists of a diverse mix adapted to the site. For these reasons, the state's reduced oversite may result in a lower revegetation success under Alternative 2 than under the existing regulations or proposed alternatives.

Under the State Management Alternative weed control would depend on state and local efforts. The lack of a comprehensive policy would likely increase the potential for infestations.

Alternative 3: Proposed Action

Alternative 3 requires that vegetation on reclaimed areas be long lasting, self-sustaining, and comparable in diversity and density to the preexisting natural vegetation. Alternative 3 also stresses the use of native plants in reclaiming mine disturbances. These requirements would impose a more specific and demanding reclamation goal than the existing regulations and result in revegetation closer to the plant communities that existed on the site before mining.

Alternative 3 requires the use of replacement growth media where low-quality topsoil would limit plant growth. Such use would tend to increase the amount of vegetation (biomass) and diversity of plants that could be established and grown on a reclaimed site over that of the existing regulations, which do not specifically address replacement growth media.

The proposed regulations would require that reasonable steps be taken to minimize the introduction of noxious weeds and limit existing infestations. The existing regulations do not specifically address noxious weed control. Therefore, Alternative 3 should lead to better weed control, and controlling noxious weeds is an important measure in promoting the establishment of a productive and desirable postmining plant community.

Under the proposed regulations, all mining and milling projects would require a Plan of Operations, resulting in a more formal review and approval of activities. This added planning should promote better revegetation compared to the existing regulations. In addition, all mining and milling operations would therefore be a federal action and subject to consultation under section 7 of the Endangered Species Act, resulting in a decrease in the likelihood of a taking of an endangered or threatened species.

Under Alternative 3, BLM would have more discretion compared to the existing regulations on the types of impacts operators may cause. The BLM could prohibit operations that would cause substantial irreparable harm to significant resources if this harm could not be mitigated. Given this provision, Alternative 3 would help to maintain population levels of threatened and endangered wildlife species at their current levels.

The Proposed Action would require reclamation bonds for all Notices. This financial assurance should prompt better compliance by the operator than would the existing regulations in reclaiming and revegetating the site. Moreover, should the operator default, BLM would have funds to reclaim the site.

Alternative 4: Maximum Protection

Alternative 4 would require that vegetation on reclaimed areas be long lasting, self-sustaining, and comparable in diversity and density to the preexisting natural vegetation, and achieve 90% of the canopy cover of adjacent, undisturbed lands. Alternative 4 would also require that only native plants be used for revegetation. These requirements would impose a more specific and demanding reclamation goal than the existing regulations and result in revegetation closer to the plant communities that existed on the site before mining.

Alternative 4 would also require that the subsurface soil be salvaged to help restore more of the original soil profile than required by the existing regulations. Restoring more of the soil profile would also promote reestablishing vegetation closer to the plant communities that existed on the site before mining.

Alternative 4 would require that operators prevent the introducing of noxious weeds and eliminate any existing infestations. The existing regulations do not specifically address noxious weed control. Therefore, Alternative 4 should lead to better weed control, which is an important measure in promoting the establishment of a productive and desirable postmining plant community.

Under Alternative 4, Notices would be eliminated and all projects except casual use would require a Plan of Operations. This would result in a more formal review and approval of activities. The added planning should promote better revegetation compared to the existing regulations. In addition, all mining and milling operations would therefore be a federal action and subject to consultation under section 7 of the Endangered Species Act, resulting in a decrease in the likelihood of a taking of an endangered or threatened species.

Alternative 4 would reduce or avoid the injury and mortality of BLM- and state-listed sensitive plant species by requiring that these species be treated as threatened and endangered under the Endangered Species Act.

Alternative 5: NRC Recommendations

Under Alternative 5, all mining projects would require a Plan of Operations, resulting in a more formal review and approval of activities. This requirement should result in better revegetation and a more desirable postmining plant community. In comparison, Notices are acceptable under the existing regulations for projects disturbing less than 5 acres. Notices are not subject to agency approval and may proceed 15 calendar days after submittal. This time frame sometimes leaves inadequate time to identify resources, evaluate impacts, and seek changes from the operator when needed to avoid or minimize impacts.

Compared to the existing regulations, the bonding required by Alternative 5 should prompt better compliance by operators with reclamation measures, including revegetation of sites. Should an operator default, BLM would have funds to reclaim the site. BLM does not have such funds under the existing regulations.

Cumulative and Residual Impacts to Vegetation Resources

An estimated 214,000 acres of public lands were disturbed by exploration and mining in the first 18 years after the 3809 regulations went into effect in 1981. Projections for mineral activities over the next 20 years show that mineral operations under the existing regulations and alternatives would disturb as much as 183,000 more acres. The total surface disturbance on vegetation from past and reasonably foreseeable mineral activities over the final EIS period, therefore, would equal as much as 400,000 acres. This amount represents about 0.12% of the total acreage of public lands and Stock Raising Homestead Act lands administered by BLM within the study area (see Table 3-1). The cumulative impact from mining and exploration on vegetation within the study area is therefore limited.

Residual impacts on vegetation would affect the 400,000 acres disturbed by mineral activities. As discussed in the proceeding section on soil resources, mining changes the original soil profile, which ordinarily requires hundreds to tens of thousands of years to develop. Mining might therefore yield soil substrates that greatly differ from what was there before mining. These differing substrates might affect the rate of succession or completely alter it. Different trajectories of succession are therefore possible, and this altered succession represents a loss of plant communities that existed on the site before mining. Alternative 4 would require more of the soil profile to be salvaged than would the other alternatives, resulting in a better chance of establishing similar substrates able to support vegetation that existed on a site before mining.

Riparian-Wetland Resources

Affected Environment

BLM manages 181,000 miles of stream and lake shore riparian habitat and 13 million acres of wetlands consisting of swamps, bogs, marshes, muskegs, and wet meadows (Table 3-23). Even though this ecotype represents only 5% of the land BLM manages, it consists of some of the most productive habitat on BLM-managed land. These valuable riparian-wetlands are not protected under one comprehensive national wetland law. Rather, federal statutes regulating or otherwise protecting wetlands have evolved piecemeal over the years and often use laws intended for other purposes (GAO 1991b).

Definitions used by agencies to determine regulatory jurisdiction over riparian-wetland areas are as variable as the classifications of riparian-wetland areas themselves (Cowardin and others 1979). The U.S. Army Corps of Engineers and BLM use the two definitions described below for managing wetlands on BLM-administered lands.

Congress enacted the Clean Water Act in 1972 to maintain and restore the chemical, physical, and biological integrity of the waters of the United States. Section 404 of the Clean Water Act authorizes the Secretary of the Army to issue permits for the discharge of dredged or fill material into the waters of the United States, including wetlands. During 1987 the Army Corps of Engineers established the guidelines and methods for determining whether an area is a wetland (jurisdictional) for the purposes of permitting and enforcing Section 404. The Army Corps of Engineers and the Environmental Protection Agency (EPA) defined "wetland" as follows:

> *Those areas that are inundated or saturated by surface or ground water (hydrology) at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation (hydrophytes) typically adapted for life in saturated soil conditions (hydric soils). Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 232.2(r), Environmental Laboratory 1987).*

Jurisdictional wetlands–those regulated by the Army Corps of Engineers under Section 404 of the Clean Water Act–must exhibit all three characteristics: hydrophytes, hydric soils, and hydrology. The prevalent vegetation must consist of hydrophytic species, meaning species that can grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions. Hydric soils must be present, or the soils must have characteristics of reducing soil conditions. Last, the area must be inundated either permanently or periodically at mean water depths not exceeding 6.6 feet, or the soil must be saturated to the surface at some time during the growing season of the prevalent vegetation (Environmental Laboratory 1987).

During 1991 BLM developed its *Riparian-Wetland Initiative for the 1990's* (BLM 1991b) to provide a strategy for managing and restoring riparian-wetland areas on BLM lands. BLM

Table 3-23. Condition of BLM-Managed Riparian-Wetland Areas by State

State	Habitat Type	Proper Functioning	%	Functional at Risk	%	Non Functional	%	Unknown	%	Total
AK	Riparian (mi)	132,023	91	35	<1	812	1	11,434	8	144,304
	Wetland (ac)	12,376,200	98	unknown		unknown		188,800	2	12,565,000
AZ	Riparian (mi)	308	34	410	46	22	2	153	17	893
	Wetland (ac)	85	<1	17,949	82	3,027	14	838	4	21,899
CA	Riparian (mi)	1,865	52	1,199	33	101	3	425	12	3,590
	Wetland (ac)	11,273	85	10,571	12	413	<1	237	3	22,494
CO	Riparian (mi)	2,119	47	1,535	34	762	17	53	1	4,469
	Wetland (ac)	4,986	67	707	9	3	<1	1,780	24	7,476
ES*	Riparian (mi)	0	0	0	0	0	0	010	100	10
	Wetland (ac)	0	0	0	0	0	0	4,300	100	4,300
ID	Riparian (mi)	1,377	37	1,462	39	379	10	536	14	3,754
	Wetland (ac)	1,361	10	1,324	10	248	2	10,200	78	13,133
MT	Riparian (mi)	2,048	42	2,225	46	523	11	57	1	4,853
	Wetland (ac)	4,444	7	693	1	859	1	56,518	91	62,514
NV	Riparian (mi)	660	27	1,127	46	392	16	268	11	2,447
	Wetland (ac)	8,821	26	1,712	5	4,098	12	19,566	57	34,197
NM	Riparian (mi)	160	35	218	48	72	16	4	1	454
	Wetland (ac)	1,663	30	10	<1	776	14	3,114	56	5,563
OR	Riparian (mi)	2,678	40	3,240	48	270	4	557	8	6,745
	Wetland (ac)	126,806	86	3,521	2	478	1	15,896	11	146,703
UT	Riparian (mi)	1,798	38	1,483	31	388	8	1,053	22	4,722
	Wetland (ac)	5,047	36	3,456	24	470	3	5,207	36	14,180
WY	Riparian (mi)	1,528	32	2,476	51	649	13	177	4	4,830
	Wetland (ac)	4,236	21	5,463	27	345	2	10,236	50	20,279
Total Lower 48	Riparian (mi)	14,541	40	15,375	42	3,558	10	3,293	9	36,767
	Wetland (ac)	168,724	48	45,406	13	10,717	3	127,891	36	352,736
Total BLM	Riparian (mi)	146,564	81	15,410	9	4,370	2	14,727	11	181,071
	Wetland (ac)	12,544,924	97	45,406	<1	10,717	<1	316,691	3	12,917,738

*Eastern States. Source: *Public Land Statistics 1999* (BLM 2000a)

Manual 1737, Riparian-Wetland Area Management, defines riparian-wetland areas as follows:

> *A form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil.*

The Army Corps of Engineers does not regulate all areas that BLM considers riparian-wetland. The Corps' regulatory jurisdiction applies only to wetlands that have all three attributes: hydrophytes, hydric soils, and hydrology. BLM recognizes areas exhibiting any one of these attributes (hydrophytic vegetation) as riparian-wetland areas.

Proper Functioning Condition

One of the chief goals of BLM's Riparian-Wetland Initiative is to restore and maintain riparian- wetland areas in proper functioning condition. Proper functioning condition for riparian-wetland areas is defined in BLM Technical Reference 1737-9 (BLM 1995a):

> *Riparian-Wetland areas are functioning in proper condition when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality; filter sediments, capture bedload, and aid floodplain development; improve flood-water retention and ground water recharge; develop root masses that stabilize stream banks against cutting action; and develop diverse ponding and channel characteristics are created to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water, and vegetation.*

Riparian-wetland areas that are not functioning properly are rated as functional at risk or nonfunctional. Functional at risk areas are in functional condition, but an existing soil, water, or vegetation condition makes them susceptible to degradation. Nonfunctional areas are clearly not providing adequate vegetation, landform, or large woody debris to dissipate the stream energy of high flows and thus are not reducing erosion, improving water quality, and performing the other functions listed above. The absence of certain physical attributes, such as, a lack of floodplain, are indicators of nonfunctioning condition. Table 3-23 shows the functional status of riparian-wetlands by state.

Riparian-Wetland Functions

The capability and potential of any riparian-wetland area is dictated by the interactions of water, soils/landforms, and vegetation. These interactions depend largely on the climatic extent and frequency of flooding and drought. Water that infiltrates into floodplains of lotic (streams, springs) systems during periods of high flow returns to the channel during periods of low flow, contributing a cool source of summer base flow for many streams, especially in low-elevation alluvial valleys. Seasonal inundation of the floodplain also reduces water velocities during flooding and helps reduce downstream flood peaks. Both of these factors reduce the risk of channel erosion. Lentic riparian-wetland areas (bogs, marshes, swamps) also perform many of the same functions:

- Detaining storm runoff.
- Reducing flow peaks and erosion potential.
- Retaining and filtering sediment.
- Augmenting ground water recharge by storing water and releasing it more slowly, later into the dry season.

Riparian-wetland vegetation plays a critical role in many physical processes within all riparian- wetland areas. This vegetation promotes streambank stability and contributes organic matter and large woody material to riparian-wetland areas. Densely vegetated riparian-wetland areas buffer the input of sediment and toxic chemicals from runoff generated on adjacent lands. Riparian-wetland vegetation also aids in aquifer recharge and in floodplain development by trapping sediment (Gregory and others 1991; Henjum and others 1994; Hicks and others 1991; Kovalchik and Elmore 1992; Sedell and others 1990).

The Role of Riparian-Wetlands Areas as Habitat

Riparian-wetland areas contain the most biologically diverse habitats on BLM-managed lands because of their closeness to water bodies and because they provide a variety of structural features, including live and dead vegetation. These areas are valuable to wildlife for food, cover, and water, and provide the following:

- Important habitat for about 80% of our wildlife species.
- Nesting and brooding habitat for birds.
- Thermal cover and favorable microclimates because of their shade, increased humidity and air movement, and higher rate of transpiration.

Common deciduous trees and shrubs such as cottonwood, alder, and willow are important food sources for deer, elk, moose, hares, rabbits, voles, and other animals.

Riparian-wetlands also perform the following functions:

- Serve as big game migration routes between summer and winter ranges.
- Provide travel corridors between habitat types for many species, including carnivores, birds, bats, and small mammals.
- Play an essential role within landscapes as corridors for the dispersal of plants.

More bird species use these areas than any other habitat type. Many neotropical migratory birds use these areas exclusively or in combination with only one other habitat type. In the Interior Columbia River Basin, 64% of neotropical migratory land birds depend on riparian-wetland vegetation during the breeding season. This habitat may harbor from 2 to10 times as many birds as does adjacent, nonriparian-wetland vegetation (Partners in Flight 1998).

Riparian-wetland vegetation directly influences the condition, quality, and maintenance of aquatic habitat. The complexity, hydraulic resistance, and stability given by riparian vegetation to streams often affect the size, shape, and distribution of channel features such as pools, riffles, and undercut banks (Sedell and Beschta 1991). Streamside vegetation moderates water temperatures throughout the year by creating shade in the summer and providing insulation in the winter. The sediment and chemical filtering function of riparian-wetland vegetation helps maintain high water quality required by many aquatic organisms.

Riparian-wetland vegetation also alters the relatively simple chemistry of nutrient production and transport into a complex array of storage locations, transformations, and nutrient spirals (Gregory and others 1987; Pinay and others 1990). In addition, riparian-wetland vegetation helps to maintain the hydrologic connectivity between main-stem stream channels and smaller side channels and hyporheic zones (Stanford and Ward 1988; Gilbert and others 1990).

Status of Riparian-Wetland Areas

Over the past 100 to150 years, riparian areas and wetlands have been subject to increasingly concentrated and competing resource demands, including the following:

- Water withdrawal.
- Mineral, sand, and gravel extraction.
- Human settlement.
- Farming and timber harvesting.
- Livestock and wildlife use.
- Recreation.

Many riparian-wetlands have been drained, filled, or sprayed with herbicides and pesticides.

Additionally, riparian-wetland areas have been affected by the invasion of nonnative plants and introduced aquatic and terrestrial species (bullfrogs, nutria). On many sites these nonnative species have become well established, commonly replacing native species or exerting large influences on native habitats. As a result, many riparian areas and wetlands are greatly altered from conditions noted by explorers in the early 1800s. Riparian-wetland systems are responsive and dynamic. When modified, they can significantly affect adjacent aquatic and terrestrial ecosystems.

Broad-scaled trends generally show that riparian-wetland areas have been reduced in abundance and that habitat fragmentation has significantly increased. In some regions of the country 95% of the riparian-wetlands historically present are gone. According to BLM (1998c), 58% of all flowing-water areas that have been assessed are either nonfunctional or functional at risk, whereas 26% of all standing-water areas were assessed as nonfunctional or functional at risk. BLM reported that from 1981 to 1997 a total of 20,127 acres of riparian-wetland habitat were lost or degraded by placer mining alone.

Other types of mining also affect riparian-wetland areas but to a lesser degree. For example, riparian-wetland disturbance estimates in the Zortman-Landusky Mine EIS suggest that from 1% to 2% of the total land affected by open pit mining may be riparian areas or wetlands (BLM and Montana Dept. of Environmental Quality 1996). Some of the mining since 1981, particularly placer mining, has taken place on lands previously or historically mined. Previously disturbed riparian-wetland areas are in various states of recovery. Most of these areas would be classified as nonfunctional or functional at risk.

Effects of Mining on Riparian-Wetland Systems

Natural riparian-wetlands systems have evolved over tens, hundreds, and thousands of years. It may take 2 to 3 years for herbaceous riparian-wetlands to become structurally established. Fifteen years may be needed for a carefully managed forested riparian-wetland area to achieve canopy closure and to begin to look and function like a natural forested system. And decades to centuries may pass before the area approximates the structure and function for the habitat it was intended to duplicate (North Carolina State University 1998; BLM and Montana Dept. of Environmental Quality 1996; BLM 1988a).

Loss of Vegetation and Vegetative Function. Mineral activities, placer operations in particular, lead to a loss of riparian-wetland vegetation. Operations remove all vegetation within the active mining area before and during mine development and operation. Vegetation next to the mining area may be affected by roads, water diversions, or other development.

Riparian-wetland vegetation significantly influences the stability of uplands and certain stream types. Changes in the composition, vigor, and density of riparian vegetation can result in changes in the following:

- Sediment input from uplands.
- Stream shade.
- Protection from instream erosional processes.
- Terrestrial insect habitat.
- Contribution of detritus and structural components to the stream channel.

Disturbance to riparian-wetlands also affects water quality and esthetic values (Rosgen 1996).

Nonnative Species. One of the most pervasive and ecologically damaging effects of human activities is widespread movement of species beyond their natural range. In North America, hundreds of exotic (or nonnative) plants have become established in aquatic habitats during this century (Ricciardi and Rasmussen 1998). Typically, only a small proportion of introduced species cause significant impacts. But some of these species have had enormous ecological impacts (Schmitz and Simberloff 1997). Nationwide, nonnative species have been implicated in the decline of 42% of species listed under the Endangered Species Act.

The ability of nonnative species to spread rapidly and out compete native plants is of concern because weeds can render land unfit or greatly limit beneficial uses of the land. Human disturbance of wetland systems by activities such as mining creates conditions that may encourage the spread of invasive species. Wetland creation or restoration projects that include nonnative species can contribute to the problem by promoting their spread faster than through natural dispersal. Although wetlands that are reclaimed with or invaded by nonnative vegetation appear to be healthy, they have little or no value for biodiversity (Flack and Benton 1998).

Furthermore, some introduced species can alter riparian-wetland ecosystems processes and functions. Others may change the structure and composition of natural communities. Many riparian-wetland invaders alter the hydrologic dynamics, fire regimes, nutrient cycling, soil chemistry, or sedimentation rates in systems where they occur (Flack and Benton 1998).

Some species such as tamarisk (saltcedar) can seriously alter hydrological regimes. Tamarisk is a deep-rooted plant that transpires water at a much higher rate than native riparian-wetland species. As a result, tamarisk can greatly lower the water table. Tamarisk also promotes flooding by blocking water channels.

Spotted knapweed and yellow star thistle are two of many weeds that can infest a variety of habitat types, including hydric sites. Both of these weeds are highly competitive and easily invade disturbed lands or deteriorated sites. These deep-rooted weeds and can out compete native species with shallow roots, thereby creating weed monocultures. Spotted knapweed can inhibit the growth of surrounding vegetation by exuding toxins through its roots and leaves. As these weeds out compete the native species, the amount of bare ground increases. Increased bare ground can lead to problems with streambank stability and increased sedimentation, especially during peak flows (Williams 1997b; Elmore and Leonard 1998). Healthy riparian- wetland systems may out compete nonnative weed invasions and also inhibit the dissemination of weed seeds through filtering capabilities.

Erosion, Sedimentation, and Altered Stream Channel Morphology. Mining accelerates sediment production. Because of the large area of land disturbed by mining and the large amounts of earthen materials exposed at sites, erosion can be a major concern at mining sites. Erosion may cause significant loadings of sediments to nearby water bodies and riparian-wetland areas, especially during severe storms and high snow melt periods. Placer mining degrades or destroys channel features, increasing erosion and sedimentation. Fine sediment from erosion can clog wetland vegetation and impair the wetland's water-holding capacity. Excessive sediment loading can cause channel aggradation and further accelerate bank instability (Elmore and Leonard 1998).

In streams with hard bottoms, accelerated runoff can result in destructive lateral erosion of streambanks and progressively wider and shallower stream channels. In streams with soft bottoms, accelerated runoff can trigger downcutting, which has the following effects:

- Lowers the streambed and water table.
- Dries out riparian areas.
- Destabilizes streambanks.
- Increases erosion.
- Further accelerates runoff.

Unless stopped by some form of intervention or a hard geologic formation, downcutting will migrate upstream and eventually disrupt the hydrologic functioning of the entire watershed (Chaney and others 1993).

Surface erosion, which occurs in denuded areas, is a major contributor to sedimentation in rivers. An example of how surface erosion can introduce sediment into rivers was demonstrated by a New Mexico study that found the following:

- Surface erosion produced 13,600 tons per square mile per year.
- Gully erosion contributed 200 tons.
- Mass movement involved 90 tons (Leopold 1994).

Stream channels become unstable when excessive sediment deposition leads to destructive lateral erosion of streambank and progressively wider and shallower stream channels.

Stream channels are commonly relocated into bypass channels during placer operations. Alterations of channel morphology result in three possible outcomes:

- Moving the main water flow from a natural channel to an upland soil and associated vegetation can result in either vertical or lateral instability depending on the soil type and underlying geology.
- Stream channel relocation often results in the straightening or decreasing of the total channel length. This decrease in length increases the gradient and energy, resulting in incision. Downcutting from such an incision can progress far above the disturbed area with the resulting sediments affecting stream morphology far downstream.
- Sediment overloading from direct inputs such as waste rock, overburden, and tailings piles; dams; roads; and newly reclaimed areas can cause channel aggradation from increased bedload. Channel aggradation increases stream energy on banks and can start lateral instability and further sedimentation. In addition, increased velocities and volume of runoff can lead to downstream flooding, scouring of stream channels, and a loss of streamside riparian vegetation (Elmore and Leonard 1998).

Pollution. Mining can release pollutants to surface and ground water, result in the depositing of contaminants into soils, and eventually lead to incorporating pollutants into plant tissue. Both water and soil contamination may harm riparian-wetland vegetation. Studies have shown a general relationship between concentrations of metals in soils and in plants (Mullen 1994; Lipton and others 1993).

Total metal accumulation by plants from soil depends on many factors, including

- The nature of the plants, species, growth rate, root size and depth, transpiration rate, and nutritional requirements.
- Soil factors such as pH, organic matter content and nature, nutrient status, amount of metal sulfides, and clay content and type.
- Environmental and management variables such as temperature, moisture, sunlight, and amendments and fertilization.
- Modes of metal toxicity and plant tolerance (Overcash and Pal 1979).

General effects of metal accumulation in plants include stunted growth of roots and tops, browning of leaves, interveinal chlorosis, wilting of the leaves, and red or brown spots on the leaves. But each case of plant phytotoxicity is different, and many plants may show no visible signs of injury (BLM and Montana Dept. of Environmental Quality 1996).

Naturally occurring substances in the ore may create a major source of pollutants. Mined ore contains not only the mineral being extracted but varying concentrations of a wide range of other minerals. Often other minerals may be present at much higher concentrations and can be much more mobile than the target mineral. Depending on the local geology, the ore and the surrounding waste rock and overburden can include trace levels of aluminum, arsenic, asbestos, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, selenium, and zinc, as well as naturally occurring radioactive materials.

Ground Water Drawdown. Ground water drawdown and associated impacts to surface waters and nearby wetlands can be a serious concern in some areas, particularly in the Carlin Trend of northeast Nevada. Several Carlin Trend gold mines are dewatering open pits. Over the last decade, these large mines have placed new and increased demands on water resources within the Humboldt River Basin. Currently, 14 large-scale and many smaller open pit gold mines are active in the basin. Large volumes of ground water are being pumped for pit dewatering, milling, and other activities.

The Nevada Engineer's Office established four acceptable methods of disposing of ground water: reinjection, storage in infiltration reservoirs, irrigation for agriculture, and discharge into surface channels. As of 1998, about 65% of the water pumped for dewatering was being discharged into tributaries of the Humboldt River, almost doubling the average annual flow of the river. This increased flow has altered natural channel morphology and flow characteristics, created temporary wetlands, and caused local flooding.

But some benefits are being realized from the discharge of the pumped water in natural water courses, including increases in water for agricultural irrigation and developing of sport fisheries in storage reservoirs. As gold mining operations cease (estimated at 15-20 years), water flows in the Humboldt River basin will be reduced to a level below premining levels. The abandoned open mine pits will fill up with water from the surrounding water tables. Water supplies in the basin are predicted to be insufficient for user demands, wildlife and fisheries needs, and maintenance of riparian/wetland areas such as the terminal wetlands in the Humboldt Wildlife Management Area. The impacts of ground water drawdown could last for many decades.

Mitigation. The most common mitigation applied to mine-related loss or disturbance is to create replacement riparian-wetland areas. Small- and large-scale mitigation can be successful and have positive ecological benefits for an area. When properly designed and maintained, the new riparian-wetland areas will eventually emulate natural systems. Although mitigation ideally provides a mechanism for both development and the protection of riparian-wetland functions, the uncertainty of creating riparian-wetlands has been a subject of concern (Reutter and Brinckerhoff 1998).

Regulatory and Enforcement Concerns. Street (1998), Reutter and Brinckerhoff (1998), and Sibbing (1997) discussed a number of problems in the mitigation process. First, few permitted riparian-wetland mitigation projects follow scientific designs. Instead, projects are often negotiated between the applicant and the regulatory agency with less site assessment or mitigation design than might be needed to guarantee success. Second, many mitigation projects fail for a lack of sustained hydrology. Poor planning and unexpected results of construction often lead to a change in ground or surface water supply to small, marginal-quality riparian- wetland areas.

Permittees may often not build wetlands, may not build a large enough area, or may build riparian-wetland areas that otherwise do not comply with the design specified in their permit. Permitting agencies sometimes allow the substitution of unlike types of riparian-wetlands in mitigation or require less-than-equal amounts of mitigation. Constructed riparian-wetland areas often do not function as expected. Finally, agency compliance monitoring is often inconsistent or cursory for key components and does not consist of detailed studies to evaluate wetland function.

Functional Replacement Concerns. A significant problem noted in mitigation compliance surveys is that, although complex wetlands may be affected, mitigation programs often create different, simpler riparian-wetland types. For example, some agencies lean toward building deeper and open water systems. This type of out-of-kind creation or restoration ignores the unique values of drier end areas, including their role in flood water storage, habitat for reptiles and amphibians, food sources for migratory waterfowl and shorebirds, and water quality improvement. Also ignored is that many nonregulatory wetland incentive programs target restoration of these same kinds of emergent wetlands, slighting drier end wetlands (Sibbing 1997). But out-of-kind mitigation can be beneficial if the wetland is dysfunctional to begin with.

Wetland functions may take many years to develop. Wooded wetlands, in particular, take a long time to become established because trees and shrubs need time to grow. Street (1998) found that a 5-year monitoring program was inadequate for assessing the effectiveness of a mitigation prescription in a wooded area. The mitigation sites examined in the study had begun to exhibit some wetland functions, but many years would be needed to see the ultimate functions provided by the sites.

The methodologies used in building mitigation sites might result in failure. Typically, construction of riparian-wetland areas includes excavating large amounts of soils to reach the level of seasonal-high ground water table. Construction commonly strips off the developed soil profile and topsoil and exposes the underlying subsoil of parent material. Although the organic matter is added to or stockpiled, little organic material remains for later incorporation. With little soil organic matter, it becomes more difficult for wetlands to remove nutrients from the ground and surface water. As a result, soils less likely to support vegetation that will filter nutrients, sediments, and pollutants. Additionally, the ability of mitigation projects to compensate for lost functions would be limited by the hydrogeomorphic characteristics of a site (Street 1998).

Location-Dependent Functions. Many of the functions and values of a particular riparian-wetland area are site specific. For this reason an agreement between the Army Corps of Engineers and EPA in 1990 determined that on-site mitigation would be used when possible. If on-site mitigation is not possible, mitigation should occur nearby and within the same watershed. Only in the absence of other options should mitigation occur outside the watershed of the affected wetland. Functions tied to landscape position include aspects of water storage and attenuation, species habitat, and nutrient cycling.

Temporal Replacement of Functions. The standard practice of constructing mitigation areas concurrently with conducting permitted wetland impacts results in temporal loss of wetland functions while the newly created areas become established, a process that can take years, even under favorable conditions. Projects may pay little regard to short-term riparian-wetland function. Many regulatory programs do not even try to offset this temporal loss of function (Reutter and Brinckerhoff 1998).

Environmental Consequences

Impacts Common to All Alternatives

The nature of impacts, as discussed above, would be similar for all alternatives where disturbance is unavoidable in accessing and extracting minerals from an ore body. In summary, loss and degradation of riparian-wetland areas might result from the following:

- Direct removal (stripping) of vegetation and loss of vegetative function.
- Increased erosion and sedimentation.
- Water and soil contamination.
- Ground water drawdown.

The level of mitigation required by each of the alternatives would help offset disturbance as discussed below.

Under all five alternatives impacts to jurisdictional wetlands would be mitigated according to Section 404 of the Clean Water Act and administered by the Army Corps of Engineers with oversight from EPA. State mitigation might also help offset wetland loss in states requiring wetland mitigation.

Alternative 1: No Action

Alternative 1 has no requirement to avoid disturbance or mitigate impacts to nonjurisdictional riparian-wetland habitat. But BLM generally mitigates impacts to riparian-wetland areas as a part of fish and wildlife rehabilitation or with water quality improvements. One of the goals of BLM's riparian-wetland policy is to restore or maintain riparian-wetland areas in proper functioning condition. But mitigation would not necessarily do the following:

- Be conducted on an acre-disturbed-per-acre-restored basis.
- Provide for scientifically designed restoration based on site-specific riparian-wetland assessments.
- Replace lost riparian-wetland function with a similarly functioning system in a timely manner.

Many years or decades would be needed for newly created riparian-wetlands to function like the natural systems they are designed to replace.

In addition, project mitigation usually would not consider the spatial distribution of natural riparian-wetland systems. Because water quality and fish and wildlife habitat parameters are more strongly correlated to riparian-wetland position than riparian-wetland extent (Pastor and Johnston 1992), the goal of attaining proper functioning condition may not be met.

Alternative 2: State Management

Because mitigation would be required only for jurisdictional wetlands (and not riparian-wetlands meet BLM's but not the Army Corps of Engineers definition), riparian-wetlands would not be restored on a large portion of the disturbed riparian-wetland habitat. For example, Newmont Gold's South Operations project could disturb 1,342 acres of riparian-wetland (streambank) habitat, of which 64% is within the jurisdiction of the Army Corps of Engineers (EPA 1997).

If jurisdictional wetlands make up 64% of the total affected riparian-wetland area, Alternative 2 could cause a long-term loss of 36% more riparian-wetland areas than would Alternative 1, except in states having standards addressing the postmining condition of fish and wildlife habitat. In these states, riparian-wetlands might indirectly benefit as a result of mitigation or rehabilitation required for fish and wildlife. For example, California recommends that wildlife habitat be restored to its premining condition (McElfish and others 1996).

Alternative 3: Proposed Action

Disturbance to riparian-wetland habitat would likely be reduced in areas away from the ore body. Such areas would undergo less disturbance from construction of access, waste rock placement, tailings impoundments, and leaching facilities. Riparian-wetlands within the area of the ore body would likely be lost or degraded. Where disturbance is unavoidable, operators would be required to apply riparian-wetland mitigation. The weakness in the mitigation process would be that similarly functioning riparian-wetland areas would probably not be replaced in a timely manner or by similarly located riparian-wetlands. Many years or decades would be needed for newly created riparian-wetlands to function like the natural systems they are designed to replace.

Under the Proposed Action all mining would require a Plan of Operations. BLM's ability to require baseline environmental information for Plan-level operations, such as detailed studies of riparian-wetland function, should help increase the success rate of riparian-wetland mitigation through improved design. Exploration disturbing less than 5 acres would be allowed under a Notice, but the bonding of Notice-level operations and the requirement to meet the performance standards to prevent unnecessary or undue degradation should greatly reduce disturbance or reduce long periods of nonfunctioning riparian-wetlands resulting from Notice-level operations in the past.

Bonding requirements under the Proposed Action would not address unplanned events such as spills or facility failures or unforeseen changes to water supply or quality. Therefore, riparian- wetland resources might be exposed to these impacts without monetary support for corrective action. In areas having unusually high-value riparian-wetlands, or riparian-wetlands that support other species of significant value (e.g. endangered species), BLM might deny mining if operators could not suitably mitigate adverse impacts.

Alternative 4: Maximum Protection

Under Alternative 4 impacts to riparian-wetland resources would generally be similar to those under the other alternatives. But the duration and extent of the impacts could be greatly reduced by the restoration time requirement. As under Alternative 3, Alternative 4 would reduce disturbance to riparian-wetland habitat away from the immediate vicinity of the ore body. Riparian-wetlands within the area of the ore body would likely be lost or degraded.

Where disturbance is unavoidable, riparian-wetlands would be restored or replaced to a proper functioning condition within 10 years of the completion of mining and at a rate of 1.5 acres restored per 1 acre disturbed. The less-than-certain nature of mitigation would be somewhat offset by the following:

- The time requirement for restoration.
- The proper functioning condition standard.
- The greater restoration-to-disturbance ratio
- BLM's ability to require baseline environmental information, such as detailed studies of riparian-wetland function.

Bonding under this alternative would cover unplanned events. As a result, financial guarantees would help correct situations in which unforseen events harm riparian-wetland resources.

As under Alternative 3, Alternative 4 incorporates the substantial irreparable harm standard into the definition of unnecessary or undue degradation. In addition, Alternative 4 would require that riparian-wetland areas be restored to proper functioning condition within 10 years after mining ceases. In combination, these two elements of Alternative 4 would much better protect riparian- wetland areas than would the other alternatives. Under Alternative 4 BLM could deny mining in riparian-wetland areas when mitigation is not predicted to meet the 10-year restoration requirement.

Alternative 5: NRC Recommendations

Under Alternative 5, mining would require a Plan of Operations, and exploration disturbing less than 5 acres would require a Notice as under Alternative 3. Notice-level bonding under Alternative 5 would help ensure that performance standards are met, but bonding would not cover unplanned events that degrade riparian-wetland habitat. The definition of unnecessary or undue degradation under Alternative 5 would not include the substantial irreparable harm standard. Thus BLM could not deny mining in areas of high-value riparian-wetland habitat when disturbance could not be mitigated.

Alternative 5 would slightly better protect riparian resources than would Alternative 1 because of the new riparian performance standard. But Alternative 5's riparian performance standard would not include wetlands and would protect only the wetlands that meet the Army Corps of Engineers' jurisdictional standard. In addition, Alternative

5 would not require restoring riparian-wetlands to proper functioning condition.

Aquatic Resources

Affected Environment

The aquatic community consists of three main components:

- Aquatic plants (phytoplankton, periphyton, and rooted vascular macrophytes), which fix energy from sunlight.
- Bacteria and fungi, which decompose organic matter.
- Consumers, including invertebrates and fish, which use energy from plants, bacteria, and fungi.

The habitat requirements for fish include a healthy, functioning aquatic ecosystem consisting of all three community components, as well as the proper physical and chemical attributes.

Aquatic Habitat and the Fish It Supports

BLM manages 132,190 miles of fish-bearing stream habitat, which includes 17,281 miles of habitat used by anadromous species. In addition, BLM manages more than 2.9 million surface acres of lake and reservoir habitat (Table 3-24).

Table 3-24. BLM-Managed Fisheries Habitat by State

State	Total Fish-bearing Stream Miles	Anadromous Stream Miles	Lake and Reservoir Surface Acres
Alaska	115,000	15,145	2,600,000
Arizona	700	0	14,200
California	850	220	163,000
Colorado	1,900	0	17,600
Eastern States	20	0	3,620
Idaho	2,820	314	750
Montana	720	0	6,670
New Mexico	260	0	120
Nevada	1,400	0	33,190
Oregon/Washington	3,200	1,602	32,770
Utah	3,390	0	15,230
Wyoming	1,930	0	6,430
Totals	132,190	17,281	2,893,580

Source: BLM 1993, 1996a.

This habitat ranges from high mountain lakes to reservoirs and from large rivers to small first- order tributaries. These aquatic systems occur in a wide variety of climatic and regional settings, ranging from the arid regions of Arizona, New Mexico, and southern California, to the more temperate streams of the Pacific Northwest and the arctic systems of Alaska.

Table 3-25. BLM Aquatic Habitat Under or Proposed for Special Status

Status	Stream Miles	Surface Acres of Lakes
Areas of Critical Environmental Concern (ACEC)	3,200	1,500
Wilderness Areas	90	NA
National Conservation Areas	1,600	250
Wild and Scenic Rivers	1,100	NA
Wilderness Study Areas (43 CFR 3802)	1,200	5,600
Proposed for Special Designation	1,980	860
Total	9,170	8,210

Source: BLM 1993

Of the total aquatic habitat under BLM administration, 7% (9,170 miles) of the stream and 0.3% (8,210 acres) of the lake habitat are under or proposed for special status. The breakdown of the special status areas is shown in Table 3-25.

To date, only about 3% of the stream habitat and 1% of the lake habitat under BLM management has been intensively inventoried for habitat condition, quantity, and trend, or had management objectives developed through habitat management plans, (BLM 1993; 1996a). Of the 1,700 miles of nonanadromous stream and 39,500 acres of lake habitat for which objectives have been developed, about half of the habitat meets the objectives (BLM 1993). About 33% (1,220 miles) of the anadromous stream habitat managed by BLM in California, Oregon, Washington, and Idaho is in optimal condition. The remainder is in fair to minimal condition. In Alaska 98% (14,800 miles) of the anadromous stream habitat under BLM management is considered to be in natural or near-natural condition, and 2% (319 miles) is in fair to minimal condition (BLM 1996a).

BLM defines optimal, fair, and minimal aquatic habitat conditions as follows:

Optimal aquatic habitat condition: *watershed not greatly impacted. Riparian areas in near natural condition; abundant, diverse instream structure. Numerous deep, complex pools with cover. Substrate (gravels) relatively free of fine sediment. Stable streambanks and stream channels. Water quality and quantity are generally unaltered from natural conditions.*

Fair aquatic habitat condition: *watershed minimally impacted by activities in the past; natural riparian vegetation altered or removed in past; limited amounts of large woody debris; fine sediments above natural levels; some adverse changes in water quality and quantity; habitat partly recovered or still in a decreasing trend.*

***Minimal aquatic habitat condition:** major alterations in the watershed, water quality, water quantity, or natural stream habitat and riparian areas; few or no large trees or mature native vegetation in riparian areas; little or no large woody debris; pools few and shallow; and excessive sedimentation of the streambed.*

From 4% to 8% of the 790 species of native freshwater fish in the United States inhabit each of the western states within the study area (Page and Burr 1991). About 90% of these fish are nongame species, and many have a limited distribution and are found nowhere else in the world. The species inhabiting BLM public lands are best represented by members of the following families: Salmonidae (nonanadromous and anadromous salmonids); Cottidae (sculpin); Catostomidae (suckers); Esocidae (pike); Percidae (darters and other perches); Centrarchidae (sunfishes); Cyprinidae (minnows); Cyprinodontidae (killifishes); Ictaluridae (bullhead catfishes); Petromyzontidae (lampreys); Gadidae (burbot); and Gasterosteidae (sticklebacks).

Much is known about the life history and habitat requirements of some of these species, and nothing is known about others. All of the species are important to the natural functioning of their ecosystems, and many species have social or economic value.

Habitat Factors That Influence Fish Abundance

Habitat needs for fish vary with the species, season of the year, and life stage. A variety of chemical, physical, and biological parameters interact to provide the range of environmental conditions that allow the species to exist. Some of the more important parameters include water quality, streamflow, cover, substrate, and energy (food) availability. These parameters are directly influenced by riparian function. But the following all play a role in defining the condition: climate, geology, soils, topography, upland vegetation, hydrology, land use within a watershed, and quality of the aquatic environment.

Fish respond to these parameters both physiologically (altered growth rates and health) and behaviorally (site selection and community interaction). Fish generally respond to these environmental factors in combination. Where fish can live and reproduce, the range of environmental conditions must be suitable throughout their lives. To show the complexity and often narrow range of environmental conditions required by fish, the following narrative [from Bjornn and Reiser (1991) unless otherwise cited] discusses the habitat requirements of salmonids (e.g. trout, salmon, and char), a group that represents many species in streams near land open to mining.

Water Quality. Salmonids require water with the following characteristics:

- High concentration of dissolved oxygen (>75% saturation).
- Nearly neutral to slightly alkaline (pH 6.5-8.7).
- Free from toxic concentrations of heavy metals and other chemicals.
- Sediment levels (bedload and suspended) that approximate natural undisturbed conditions.

In addition, water temperature plays a crucial role in defining suitable water quality for fish.

The timing of salmonid spawning has evolved in response to water temperatures in each stream before, during, and after spawning. Water temperatures can influence the upstream migration of adult spawners and delay the entry of spawners into their natal streams.

Temperature also determines the rate of embryo and alevin (newly hatched fish still attached to the egg yolk) development. Within the temperature threshold for successful spawning and incubation, 4-14°C (Bell 1986), warmer temperatures result in shorter development times. In many streams winter temperatures fall below the 4°C minimum recommended for incubation, but the eggs develop normally because the spawning and development occurred when temperatures were within the suitable range.

Water temperature also determines the capacity of water to hold oxygen in solution. The relationship is an inverse one, with oxygen solubility lower in warmer water. Salmonids can survive relatively low concentrations of dissolved oxygen for short periods. But low concentrations adversely affect growth rate, swimming performance, and the efficiency of food conversion.

Streamflow and Water Velocity. Adequate streamflow is important for providing fish passage (both for upstream migrating adults and downstream migrating juveniles). Streamflow also regulates the amount of spawning and rearing area by controlling the wetted perimeter and the depth and velocity of water. Streamflow also determines stream channel morphology, bed material particle size, and a stream's capacity to transport sediment. These parameters in turn determine the quality and distribution of aquatic habitat types.

Next to flow, water velocity is probably the most important variable in determining the amount of living space for fish. If velocities are unsuitable, no fish will be present. Natural streams have a variety of velocities, some of which are suitable for fish. The velocities suitable for salmonids vary with life stage of the fish, the species, and the season of the year.

Cover. In-stream cover gives fish security from predation and displacement during high flows and allows fish to use portions of a stream they might not otherwise be able to use. Some of the more common cover elements include the following:

- Deep water
- Water turbulence
- Large-particle substrates
- Overhanging riparian vegetation
- Undercut streambanks
- Woody debris
- Aquatic vegetation

The cover requirements of fish change diurnally, seasonally, and by species and life stage. Cover has been correlated to fish abundance and is an important aspect of quality habitat.

Substrate. Streambed substrate gives juvenile fish cover from predators and adverse environmental conditions, serves as habitat for aquatic invertebrates, often provides a substantial component of the fish's diet, and contributes to the quality of spawning, incubation, and rearing habitat.

The interstitial space (voids) between substrate particles provide instream cover. In many streams large-particle substrate is the main cover type along with water turbulence and depth. Small-particle substrates, such as silt and sand, are of no value as cover for fish. Small fish such as newly emerged fry can use substrates consisting of 2-5 cm diameter rocks, whereas larger fish require cobble- and boulder-size material.

Aquatic invertebrates, which are a primary food for fish, are produced in the substrate. Some types of invertebrates are more suited to fine-particle substrates than others. But watershed disturbance and erosion can add fine sediments, which can reduce the abundance of many species of invertebrates, resulting in reduced fish production.

When an adult salmonid selects a spawning site, it is also selecting the incubation environment. Redd (nest) construction displaces fine sediment and organic material from the redd and rearranges larger substrate material such as gravel and rubble, making the site as favorable to egg development as it will ever be. As the incubation period proceeds, redds may become less suitable to developing embryos if fine sediment and organic material are deposited in the interstitial space between particles.

The fine sediment can impede the movement of water and alevins from the redd, and the organic matter can consume dissolved oxygen during decomposition. If organic matter consumes dissolved oxygen faster than the reduced intragravel water flow can replace it, the embryos or alevins will asphyxiate. The amount of fine sediment deposited and the depth to which it intrudes depends on the size of substrate in the redd, flow conditions in the stream, and the amount and size of sediment being carried.

Energy Flow and Stream Productivity. Stream and terrestrial ecosystems are closely linked. The flow of water, sediment, nutrients, and organic matter from the surrounding watershed shapes the physical habitat and supplies energy and nutrients to the stream community. Activities of the many components of the stream community influence the flow of energy from primary production to decomposition. As predators, salmonids are influenced by energy-flow processes operating at all levels in the stream ecosystem (Murphy and Meehan 1991).

Streams vary in productivity, largely in response to nutrients and energy. Energy comes to the stream community from two main sources: photosynthesis by aquatic plants in the stream and decomposition of organic matter imported from upland and riparian areas outside the stream. Imported energy sources contribute organic matter to a stream by four main pathways: litter fall from streamside vegetation, ground water seepage, soil erosion, and fluvial transport from upstream. In addition, animals can contribute important amounts of organic matter and nutrients.

Streamside vegetation provides large amounts of organic matter when leaves, needles, and woody debris fall into the stream. Leaves and needles usually contribute most of the readily usable organic matter in woodland streams.

As much as 25% of a stream's total imported organic matter may enter dissolved in ground water. But the nutritional value of this dissolved organic matter is generally low, and this organic matter does not contribute much energy to the stream community (McDowell and Fisher 1976; Klotz and Matson 1978). As with ground water, most dissolved organic matter from soil erosion offers little nutritional value to the stream community.

Fluvial transport of organic material from upstream reaches becomes an energy input to downstream reaches. Upstream reaches can supply up to a third of the total organic input to small streams and nearly all the organic matter in large rivers (Vannote and others 1980). The source of fluvial transport is generated in the stream itself by invertebrate processing of detritus (Webster and Golladay 1984 in Meehan 1991) and algal cells detached from the streambed (Swanson and Bachmann 1976).

Animals transport organic matter to streams in many ways. Terrestrial insects drop into streams and are eaten by fish. Drift of aquatic insects export matter downstream. And mature insects can move matter upstream by flying. Beavers carry woody debris to streams, and grazing and browsing mammals transfer matter by feeding in uplands and defecating in the floodplain. Annual spawning runs of anadromous salmon (and decay of carcasses) can contribute large amounts of organic matter and nutrients to some streams and historically contributed a large input of organic material and nutrients to streams.

Influence of Riparian Vegetation. Watershed and riparian community condition directly influences the condition, quality, and maintenance of aquatic habitat. Riparian plants do the following:

- Filter sediments and nutrients.
- Create shade.
- Stabilize streambanks.
- Provide cover in the form of large and small woody debris.
- Produce leaf litter energy inputs.
- Promote infiltration and recharge of the alluvial aquifer (Orth and White 1993; Wesche 1993).

As a result of these functions, spawning beds for salmonids and microhabitats for macroinvertebrates remain relatively free of damaging fine-sediment deposits. Riparian vegetation reduces sedimentation of pools, thereby maintaining water depths and structural diversity of the channel. The slow release of water stored in aquifers augments base flow levels throughout the year. The interaction of streamflow and riparian features, such as living vegetation and large woody debris, often form such complex off-channel habitats as backwaters, eddies, and side channels. These areas of slower water give critical refuge during floods for a variety of aquatic species and serve as rearing areas for juvenile fish.

The bank stabilizing function of streamside vegetation not only helps reduce erosion and influence channel morphology but also acts to supplement instream cover by contributing to the development of undercut streambanks and by providing overhanging vegetation. Well-vegetated stream channels and stable streambanks help reduce the turbidity and channel scouring of high runoff and can also enhance primary production.

In Alaska and other cold regions, well-vegetated stream channels help reduce the formation of aufeis (ice formed by the overflow of water onto existing ice). Aufeis can do the following:

- Decrease primary productivity.
- Delay riparian plant growth.
- Increase erosion.
- Tie up water as ice during critical low-flow periods.
- Cause the formation of new stream channels by blocking channels (Churchill 1990; Michel 1971; Slaughter 1990).

Threatened, Endangered, and Special Status Species–Status and Trend

The population status of nonanadromous and anadromous fish species on BLM-managed land ranges from excellent to poor. Many states in the study area show a declining trend in the populations of native species. Alaska has no special status fish species, and Pacific salmon and steelhead have experienced record high abundance in the recent decade (Nehlsen 1996). Conversely, in Oregon, 25 nonanadromous species on BLM-administered land were listed as threatened, endangered, candidate, or sensitive as of 1991, and 79% of the salmon and steelhead stocks are at some risk of extinction (BLM 1996a, 1991a).

In a literature review, Nehlsen and others (1991) found that 106 anadromous salmonid populations are extinct in the Pacific Northwest and that 214 other stocks of Pacific salmon and steelhead are facing high or moderate risk of extinction, or are of special concern. A closer look by Higgins and others (1992), Nickelson and others (1992), and the Washington Department of Fisheries and others (1993) further delineated those stocks listed by Nehlsen and others (1991) and determined that as many as 512 anadromous salmonid stocks inhabit the Pacific Northwest. Of the 512 stocks found, 243 occur on BLM-managed land, and 173 (71%) are at some risk of extinction (BLM 1996a).

In addition to anadromous species, many other rare and imperiled freshwater fishes reside in BLM-managed waters. In a state-by-state study of the status of freshwater fish in the United States, Warren and Burr (1994) found the number of native fish that are endangered, threatened, or of special concern to be particularly high in Nevada (43 species, 100% of the native fishes), California (42 species, 72%), Oregon (25 species, 44%), Arizona (22 species, 85%), and New Mexico (20 species, 30%). In these states BLM manages thousands of miles/acres of stream and lake habitat.

Williams and others (1989) documented a 45% increase in the number of freshwater fishes in North America warranting special protection because of their rarity when compared with conditions 10 years earlier. They listed 147 taxa of special concern, 114 threatened, and 103 endangered. Of these 364 taxa 31% occur in waters under BLM administration. As of 1991 BLM-managed lands had 39 species of fish that were listed as threatened or endangered and 73 species considered to be candidate, BLM sensitive, or state-listed species (BLM 1991a).

In the past 6 years 26 species of fish have been added to the threatened and endangered list, bringing the total number of threatened or endangered fish on BLM-managed land to 65. These species inhabit BLM lands in all states except Alaska. (Appendix F lists threatened, endangered, and proposed candidate species.)

About 93% of the declines in fish populations are attributed to habitat loss and destruction (Williams and others 1989). But mining has not caused all habitat loss and destruction.. Physical and chemical degradation results from many factors, including dams and diversions; chemical pollution; urban and agricultural encroachment; and damage from timber harvesting, livestock grazing, and mining (Williams 1997a).

Effects of Mining on Aquatic Resources

Since the mid-1800s mining has impaired thousands of miles of aquatic habitat in the western United States (USFS 1993a; James 1989, 1991; Chertudi 1986; Kleinman 1989, Kimball and others 1995; Finlayson and Verrue 1980; Canfield and others 1994). It is difficult to measure the amount of BLM-managed aquatic habitat that has been disturbed since 1981. The data for BLM-managed land does not distinguish between disturbance to aquatic habitat and disturbance to upland areas. In addition, information on disturbance does not include indirect offsite impacts that can result from changes to water quality or quantity or to stream morphology.

Finally, the quality of BLM-managed aquatic habitat may be impaired by mining on non-BLM- managed lands upstream or on adjacent uplands. Between 1981 and 1997, placer mining altered an estimated 450 miles of stream on BLM-managed land. This estimate considers only direct stream channel disturbance by placer mining and not indirect offsite impacts (e.g. downstream water quality impacts). Nor does this estimate consider disturbance or impacts stemming from exploration; strip, pit, or underground mining; or independent mill sites, all of which would increase the estimate. The estimate of disturbed stream length above was derived by converting past acreage estimates for placer Notice- and Plan-level operations to miles of stream channel by dividing by an average width. The average widths (300 feet for Notices and 600 feet for Plans) were obtained from BLM patent applications.

Physical Impacts. Mining, particularly placer mining, often directly alters or relocates stream channels. This alteration destroys aquatic habitat. Placer mining often diverts streams into bypass channels while the original channel is mined. Streams are then returned to newly built (reclaimed) channels once mining is complete. Stream bypasses and newly reclaimed stream channels are often built with or result in different geometry and physical characteristics (e.g. flood prone and bankfull widths, bankfull depth, sinuosity, slope, entrenchment, and substrate size) than that of the natural unmodified channel.

The difference is often due to the removal of streamside vegetation and other hard structural elements that defined the natural channel morphology. As a result, bypasses and newly reclaimed channels are often straighter, have a higher gradient, and thus have more energy than the natural channel. In addition, new channels often lack the diversity of habitats (pools, glides, riffles) and cover components (undercut bank, overhanging vegetation, large woody debris). This diversity enhances the quality of habitat in natural unmodified channels.

Altering surface hydrology often results in stream conditions that no longer provide suitable habitat to species or life stages of fish and other aquatic organisms present before disturbance. For example, increased stream flow may result in water velocities that do the following:

- Cause involuntary downstream displacement and mortality of juveniles.
- Result in scour-related mortality of eggs and alevins.
- Accelerate streambank erosion.
- Create less desirable conditions for adult fish.
- Deplete large woody debris and organic material over the long term.

The enlargement of stream channels may result in a shallow, low-velocity aquatic environment during periods of low flow. This new environment then could result in crowding, loss of spawning habitat, reduced primary and secondary productivity, increased vulnerability to predation, and increased sedimentation (Swanston 1991; Hicks and others 1991;

National Research Council 1992; Stouder and others 1997).

Mine development may also alter the natural input rate of sediment, organic matter, and nutrients to aquatic systems. Mine sites can include open pits, heap and dump leaches, waste rock and overburden piles, tailings piles and dams, haul roads and access roads, ore stockpiles, vehicle and equipment maintenance areas, and exploration and reclamation areas. These areas are all major sources of erosion and sediment.

The main factors influencing erosion on mine sites include the volume and velocity of runoff from precipitation, the rate of precipitation infiltration through the soil, the amount of plant cover, the slope length or the distance from the point of origin of overland flow to the point of deposition, and operational erosion control structures (EPA 1997).

Sediment delivery exceeding natural levels can greatly disrupt the aquatic environment. Excessive fine sediment deposited in streams can alter stream channel morphology, substrate composition, and surface-ground water interaction (Madison 1981; Bjerklie and LaPerriere 1985; Rosgen 1996). These changes can lead to decreased survival of fish in the egg and alevin stages; decreased density, biomass, and diversity of aquatic insects; and decreased primary production (Cordone and Kelley 1961; Cooper 1965; Van Nieuwenhuyse 1983; Webber and Post 1985; Lloyd and others 1987; Buhl and Hamiltion 1990).

Suction dredging has been shown to locally reduce benthic (bottom dwelling) invertebrates (Thomas 1985; Harvey 1986) and cause mortality to early life stages of fish due to entrainment by the dredging equipment (Griffith and Andrews 1981). Suction dredging may also do the following:

- Destabilize spawning and incubation habitat.
- Remove large roughness elements such as boulders and woody debris that are important for forming pool habitat and that can govern the location and deposition of spawning gravels (Harvey and Lisle 1998).
- Increase suspended sediment, decreasing the feeding efficiency of sight-feeding fish (Barrett and others 1992).
- Reduce living space by depositing fine sediment (Harvey 1986).
- Cause fish to avoid certain habitats because of their response to divers (Roelofs 1983).

On the other hand, suction dredging may temporarily improve physical fish habitat by creating deep pools or by creating more living space by stacking large unembedded substrate (Harvey and Lisle 1998). In general, invertebrates and periphyton all rapidly recolonize small patches of new or disturbed substrate in streams as long as the area of disturbance is not so widespread as to limit the number of organisms available to recolonize (Griffith and Andrews 1981; Thomas 1985; Harvey 1986). In addition, dredge tailings may increase spawning sites in streams lacking spawning gravel or in streams that are armored by substrate too large to be moved by fish (Kondolf and others 1991). In some cases the reduction in the feeding efficiency of fish may be offset by reduced visibility and the corresponding reduced risk of predation at moderate levels of suspended sediment (Gregory 1993).

The current state of knowledge of suction dredging and its impacts on aquatic resources suggests that the practice could be either detrimental or beneficial, depending on site-specific use by aquatic organisms and physical habitat limitations. In either case, the location and timing of suction dredging must be evaluated to determine potential impacts on fish and other aquatic resources.

Water Quality and Quantity Impacts. Water pollution from acid rock drainage is one of the most serious and persistent problem facing the mining industry. Acid rock drainage can result from the exposure to water and air of material containing metallic sulfides such as pyrite, saphalerite, and galena.

The chemical reaction that produces acid rock drainage occurs naturally due to weathering. But mining can accelerate the reaction by exposing large amounts of sulfide-bearing material. When exposed, these sulfide minerals readily oxidize in water to form sulfuric acid.

Runoff and seepage from sulfide-bearing material may have a low pH (2.0-4.5), which is directly toxic to most forms of aquatic life and mobilizes (dissolves) toxic metals. Water can carry the toxic metals many miles from their source (Johns and Moore 1985). Although testing methods used to predict acid rock drainage have improved in recent years, there is often substantial uncertainty about the predictions. Moreover, new mines can develop unpredicted acid rock drainage after only a few years of operation or after mine closure (EPA 1997).

Acid rock drainage from both abandoned and active mines has damaged many miles of aquatic habitat. On Forest Service land alone, acid rock drainage has impaired an estimated 5,000 to 10,000 miles of streams (EPA 1997). Metal mining materials and wastes that have the potential to generate acid rock drainage include tailings, waste rock, overburden, and spent ore from heap and dump leach operations. Equally or more important at some sites are the pit walls at surface mining operations and the underground workings of underground mines. Acid rock drainage can also occur in pit mining lakes formed.

In Nevada over the next 20 years mining is predicted to form 30 pit lakes. When filled by ground water, these lakes will contain more than 1 million acre-feet of water that one researcher predicts will likely be permanently toxic to wildlife (Miller and others 1996). The potential threat to aquatic life from contaminants mobilizing in a pit lake or in ground water next to a pit lake can vary from site to site.

Common rates of ground water movement are 150 to 200 feet per year in fine to medium sands and 1,000 to 2,000 feet per year in gravels. The actual ground water flow rate depends on the hydraulic conductivity of the aquifer and the ground water gradient. Contaminants such as metals may travel at slower rates than ground water depending on the constituent and its interaction with the soil type (Grabert 1998). In addition, hydrodynamic dispersion, which spreads the contaminate plume in a direction perpendicular to the flow, will affect how big the plume becomes.

Metals are naturally present in all surface waters and are required by aquatic organisms in trace amounts. Mining may cause the concentration of dissolved metals to exceed the natural background levels within streams and lakes. The chief metals released to streams and lakes by mines are arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, and zinc. At high concentrations, metals may kill aquatic organisms. At prolonged exposure to sublethal concentrations of metals, organisms may experience behavioral changes and reproductive failure (Chapman 1973).

Metal precipitates that originate in some waste rock dumps can be highly mobile and be transported long distances in streams. Metals in this solid phase have resulted in reduced density and diversity of aquatic invertebrates and food chain contamination in areas removed (more than15 miles) from the contamination source. Metal-contaminated diets have been found to cause reduced growth, histopathological (tissue change) effects, and reduced survival in trout. Exposure to metals in the diet have caused greater adverse effects to trout than exposure to metals in solution (Farag and others 1994; Ingersoll and others 1994; Kemble and others 1994; Moore and others 1991; Woodward and others 1994).

Cyanide is toxic in its free form, hydrogen cyanide (HCN), as the cyanide ion (CN-), and as breakdown compounds such as cyanates, thiocyanates, chloroamines, cyanogen chloride, and metal-cyanide complexes (Moran 1998). Although free cyanide does not persist in the natural environment and does not bioaccumulate through the food chain, many of the breakdown complexes do bioaccumulate, and some are especially toxic to fish. Consequently, the exposure of surface waters to cyanide compounds resulting from leaching, seepage, accidental discharge, emergency releases, and runoff can be harmful or lethal to aquatic life.

Since the 1980s, many major cyanide spills have occurred. On the Zortman-Landusky mine in Montana, cyanide has been detected in every sample of ground water collected between 1992 and 1995 from Montana Gulch. The cyanide contamination at this location was attributed to a pipeline rupture below a leach pad in 1992 (BLM and Montana Dept. of Environmental Quality 1996). The most notable cyanide spill occurred in South Carolina in 1990, when a dam failure released 10 million gallons of cyanide solution, killing fish for 50 miles downstream from the mine (EPA 1997).

Many native fish have evolved according to specific patterns of annual and seasonal precipitation, runoff, and stream flow. Most of these species have enough flexibility in the timing of their maturation, migration, and reproduction life stages to allow them to survive temporary periods of unfavorable conditions. But mining can change the natural surface and subsurface hydrology to such an extent that some species cannot survive.

Surface mining commonly strips land of its vegetation and topsoil. Such a condition can lead to the following:

- A decreased water infiltration capacity of the remaining soils.
- Increased overland flow.
- Decreased lag time between precipitation events and runoff.
- Increased streamflow over short periods of time.

Any increase in overland flow, particularly over disturbed areas, will increase the amount of sediment introduced into a stream. The increased overland flow and sediment input places hydrological stresses on the receiving stream channel and will eventually lead to erosion, destabilization, and enlargement of the stream channel.

Water consumption is another aspect of open pit mining that threatens aquatic resources. Because surface and ground water are inextricably connected, dewatering of aquifers by large open pit mines can change surface flow patterns. As the amount of water being intercepted and pumped from the mine increases, the size of the area subjected to a lowered water table increases. In some cases the area influenced by dewatering can extend for miles (Crompton 1995).

After mining (and pumping) is complete, many decades may be needed for the ground water to replenish (EPA 1997). In some cases more than a century may be required to reestablish the ground water supply to that of predisturbance condition (Manning 1994; BLM 1996d). In other cases dewatering of alluvial aquifers could result in the permanent loss of water storage capacity due to compaction of the aquifer (EPA 1997). As a result, flow to surrounding springs, streams, and lakes may be reduced or lost with direct consequences to aquatic species that rely on the affected water source.

In arid environments like Nevada, ground water fed springs may contain native invertebrates such as the spring snail. Loss of these unique habitats from dewatering is of particular concern because many of the species occupying these spring-fed areas are just becoming known, and in many cases no measures have been developed to protect them.

Aquatic and wetland habitats downstream of the immediate area influenced by mine dewatering may also be at risk due to the increased demand placed on water resources. An example of this influence may be seen in the Humboldt Wildlife Management Area, a terminal wetland in west- central Nevada. Agricultural water diversions and drought have reduced water delivery to the wetlands over several years.

Over the last 10 to15 years, the development of large open pit mines and related increase in population have placed new and increased demands on water within the Humboldt River Basin. These demands in turn may further reduce water delivery to the wetland and result in a corresponding decrease in water quality due to concentration of salts and other dissolved constituents.

Reclamation Practices. Reclamation under the 3809 regulations has evolved since1981. In the early1980s placer mine reclamation usually consisted of relocating the stream channel back into the lowest part of the valley on a bedrock substrate, followed by recontouring the tailings into the surrounding topography by pushing them uphill away from the stream channel and floodplain. Any available topsoil was respread over the graded tailings. Many of the sites had been mined previously or historically, and the topsoil had been lost. Occasionally operations seeded sites after applying the topsoil. But more commonly sites were left to revegetate through natural succession. Similarly, limited grading and occasional seeding often reclaimed nonplacer operations.

Today, more attention is paid to stream channel design. In some of the more recent examples of placer reclamation, newly built stream channels are modeled after the natural system or a system with similar gradient, sinuosity, dimensions, and flow. Revegetation is still usually left to natural processes, especially in Alaska. In nonplacer reclamation, seeding is now standard practice. Seeds are usually a mixture of grasses, forbs, and shrubs, and increasingly consist mostly or entirely of native species.

Unfortunately, the success of the existing regulations at rehabilitating aquatic habitat has been poor, mainly because past reclamation practices. Much of the recent emphasis on proper stream channel design has been applied only at a few mines and has yet to be evaluated. In addition, past reclamation practices did not commonly replace lost instream cover components or hard structural elements that provide habitat diversity. Many of these elements (e.g. logs, boulders, root wads) are not suitable for all channel types (Rosgen 1996) and may create unwanted hydrological stress on new stream channels, resulting in undesirable channel adjustments. Several years may be needed for a new channel to reestablish equilibrium and stability and allow lost cover components to be installed and habitat diversity to be restored.

Most of the aquatic habitat disturbed since 1981 remains in an impaired condition. Field evaluations by BLM staff and Carlson and Karle (1997) reveal that operations have rarely achieved reclamation, including reestablishing hydrologically stable drainages, properly functioning floodplains, and riparian zones, and a diverse mix of habitat types and cover components. In recent years, maintaining good water quality has been less of a problem. But during heavy precipitation or runoff, aquatic organisms may be exposed to harmful or fatal levels of sediment, turbidity, metals, and other toxic chemicals.

Environmental Consequences

Alternative 1: No Action

The removal of streamside riparian-wetland vegetation during mining would result in loss or degradation of aquatic habitat until proper functioning condition could be reestablished. In general, the time required for riparian-wetland areas to attain proper functioning condition would be dictated by natural processes and could require from 25 to 50 or more years, depending on site conditions, including soil, aspect, climate, and external disturbance factors such as livestock grazing.

Dewatering of mines could expose aquatic organisms to (1) artificially elevated levels of stream discharge during mine operation and (2) insufficient stream flow during aquifer recharge following mining. Water quality standards should be met during periods of low flow, but increased sedimentation and elevated turbidity would be expected during storms due to stream channel erosion and lack of stabilizing vegetation on disturbed sites. Because of the need for long-term or perpetual water treatment and maintenance of impoundments, aquatic life would continue to be threatened by runoff, seepage, ground water contamination from spent ore from heap and dump leach operations, tailings, waste rock, overburden material, pit walls, pit lakes, and underground mine workings.

Suction dredging might affect fish communities by doing the following:

- Reducing local food supply (invertebrates) and feeding efficiency.
- Destabilizing spawning, incubation, and rearing habitat.
- Injuring or killing early life stages.

These impacts would continue, undetected and unregulated, because BLM typically does not require a Notice or Plan of Operations.

Threatened and endangered species would be protected under the Endangered Species Act. But as with more common species, BLM- and state-listed sensitive species would continue to be displaced, injured, and killed.

Alternative 2: State Management

Impacts to aquatic habitats and communities would vary by state because of the wide range of regulatory requirements. For example, California has a highly detailed and complex regulatory system that recommends that wildlife habitat be returned to its premining condition, if not a better condition, unless the proposed end use precludes habitat. In addition, California requires the preparing of an environmental impact report (EIR) for any project that might have a substantial impact on the environment. The EIR is similar to the environmental analysis and documentation required under the National Environmental Policy Act (NEPA). In contrast, Nevada, defers to BLM reclamation standards and does not require preparing any NEPA-like documentation. Regardless of the states' regulatory requirements, the requirements under which a mine is operated are mainly determined by negotiation between the mine operator and the state (McElfish and others 1996). In general, the nature, extent, and duration of impacts under the State Management Alternative would be similar to Alternative 1.

As under Alternative 1, common species and BLM- and state-listed sensitive species would continue to be displaced, injured, or killed except for possibly in California and Oregon, which require consultation for state-listed species.

Alternative 3: Proposed Action

The Proposed Action would require operators to minimize disturbance to fish and many of the habitat parameters affecting the aquatic community. Such parameters include water quality and quantity and riparian areas. This requirement should result in less aquatic habitat being directly disturbed in areas outside the ore body. In the past, areas outside the ore body may have been disturbed to develop access, waste dumps, or other support activities for ore extraction. Where disturbance could not be avoided, the nature and duration of disturbance would be similar to that under Alternatives 1 and 2.

Some of the unavoidable disturbance to aquatic habitat would be offset by riparian-wetland mitigation. Because of BLM's ability to set the time frame (goal) for riparian recovery (and thus the level of reclamation effort applied to riparian restoration), the time needed under Alternative 3 to rehabilitate aquatic habitat to a level where it is healthy, properly functioning, and self-maintaining might be slightly less than under Alternatives 1 or 2. Over time, offsite riparian mitigation or replacement required under the Proposed Action should avoid the loss of riparian vegetation but still might not address the spatial distribution and functional processes provided by natural riparian systems (Pastor and Johnston 1992; North Carolina State University 1998).

Suction dredging would continue to affect fish communities by reducing local food supply (invertebrates) and feeding efficiency. But most impacts on early life stages of fish and of spawning, incubation, and rearing habitat could be avoided or reduced by proper timing or specifying certain areas as off limits to dredging.

Threatened and endangered species would continue to receive the same level of protection that they do now under the Endangered Species Act. Displacement, injury, and mortality of common and BLM- and state-listed sensitive species should be less where habitat disturbance outside of the area of the ore body could be minimized by such actions as relocating access roads out of riparian-wetland areas. Sensitive species would continue to be affected near the ore body.

All mining would require Plans of Operations. BLM's ability to require baseline information for Plan-level operations should help increase the success of fisheries rehabilitation. Such information might include detailed stream channel geometry, aquatic habitat composition, and documentation of species and lifestage presence or absence. Exploration disturbing less than 5 acres would be allowed under a Notice. But bonding of Notice-level operations and the requirement to meet the performance standards to prevent unnecessary or undue degradation should help ensure that areas are rehabilitated.

Bonding requirements under Alternative 3 would not address unplanned events such as spills or facility failures or unforeseen changes to water supply or water quality. Therefore, funding of corrective action would fall to BLM. In areas having unusually high-value aquatic resources, BLM might deny mining if an operation could not provide suitable mitigation.

Alternative 4: Maximum Protection

The substantial irreparable harm standard in combination with the 10-year habitat restoration time requirement would make Alternative 4 far better protect aquatic resources and reduce disturbance more than the other alternatives.

The nature of impacts to aquatic resources under Alternative 4 would be similar to that under the other alternatives. But under Alternative 4 the habitat restoration time requirement (and the corresponding increase in reclamation effort to meet this requirement) would greatly reduce the duration and extent of impacts. As under the other alternatives, the removal of streamside riparian vegetation during mining would degrade aquatic habitat and communities by the following:

- Increasing stream channel erosion and stream sedimentation.
- Promoting altered channel morphology.
- Decreasing water quality.

In addition, riparian vegetation would lose its role of providing nutrient and energy input, stream shading, instream cover components, streambank stability, and aquifer recharge. But if the operator could not project successful restoration of aquatic and riparian-wetland habitat to proper functioning condition (including suitable water supply) within 10 years after mining, BLM could deny the proposal to mine.

In addition to the requirement to restore aquatic habitat to proper functioning premining condition, all operations under Alternative 4 would be bonded to cover unplanned events.

Runoff, seepage, and ground water contamination from mining would no longer pose as great a threat to the aquatic community because of the ability to designate certain acid-producing deposits as unsuitable for mining. The result would be that acid-producing conditions would not occur in some areas, and metals would not be released into ground or surface water that accompanies low-pH conditions. In some instances, however, modeling would not foresee the potential for a deposit to produce acid (and metals).

Impacts from suction dredging would be similar to those under Alternative 3 and would mostly be avoided.

Alternative 4 would reduce or avoid the displacement, injury, and mortality of BLM- and state-listed sensitive species by the requirement to treat these species as threatened and endangered under the Endangered Species Act.

Alternative 5: NRC Recommendations

Under Alternative 5 mining would require Plans of Operations, and exploration disturbing less than 5 acres would require Notices, as under Alternative 3. Notice-level bonding would help ensure that performance standards are met, but bonding would not cover unplanned events that could degrade aquatic resources. The definition of unnecessary or undue degradation would not include the substantial irreparable harm standard, and BLM could not deny mining in areas with high-value aquatic resources. Under Alternative 5 aquatic resources would receive similar protection as under Alternative 1.

Cumulative and Residual Impacts

Unavoidable direct disturbance to aquatic and riparian habitat would require many years (25 to 50+) to recover to healthy functioning condition. This recovery period might be prolonged in some areas, depending on how the land is used after reclamation. For example, livestock grazing might extend the time for streamside riparian vegetation to become established. Some of the mining, especially placer mining, might take place on previously worked claims, setting back aquatic/riparian habitat recovery by the number of years between the previous and future disturbance.

In summary, placer mining disturbed an estimated 450 miles of stream channels between 1981 and 1997 and is predicted to disturb a similar amount for the 20-year analysis period. In addition, direct and indirect disturbance to aquatic-riparian habitat from exploration; strip, pit, or underground mining; or independent mill sites could substantially increase this estimate, possibly doubling it. The result would be an estimated total cumulative disturbance of 1,500 to 2,000 miles of aquatic/riparian habitat in addition to the thousands of miles of aquatic/riparian habitat still being affected by historic operations.

All alternatives might have residual impacts from operations causing acid production, and might result in the associated need to treat water and maintain impoundment facilities for long periods, or perpetually. In addition, erosion, the altering of surface hydrology, and the introducing of sediment beyond the ability of streams to transport it would result in channel instability and undesirable channel adjustments that might affect streams over much of their length. Channel adjustments, in turn, could degrade offsite aquatic-riparian habitat.

In areas subjected to large-scale ground water withdrawals, many decades may be required before ground water levels recover and the connection to dependent streams, springs, and seeps is reestablished. The recovery of ground water levels may be prolonged by other competing uses of the water.

Wildlife Resources

Affected Environment

A great diversity of aquatic (amphibians) and terrestrial animal species inhabit federally managed public lands. Equally diverse are the vegetation communities that serve as habitat for these unique assemblages of aquatic and terrestrial species. Federal lands across the West provide seasonal or permanent habitat for more than 3,000 species of amphibians, reptiles, birds, mammals, and fish.

Amphibians and Reptiles

Information on the distribution and abundance of amphibians on BLM-managed lands is limited. Amphibians are difficult to survey because localized populations fluctuate widely over time, and trends are difficult to determine. Moreover, distribution and abundance are tied closely to specific substrates and microhabitat conditions. Most amphibians require moist sites or standing to flowing water for egg-laying and larval development. Amphibians mainly live in riparian, wetland, and aquatic habitats, but a few inhabit grasslands and coniferous-deciduous forests.

Amphibian populations have declined in the past decade (Vitt and others 1990). Although no single factor has been found to cause declines, many factors are suspected. The dramatic loss of wetlands to land development and farming has directly affected amphibians. Introducing exotic species such as bullfrogs, trout, and carp can reduce amphibian populations through predation or destruction of food and breeding habitat. Some species have a high tolerance for changes in water quality. Others, such as the Idaho giant salamander, do not. The following actions may alter water quality enough to harm adults, reproduction, and food sources (Freda and others 1991; Quigley and others 1997):

- Runoff from roads.
- Use of herbicides and pesticides.
- Increased sedimentation from mining, farming, forestry, and recreation.

As with amphibians, information is limited on population distribution and abundance of reptiles on BLM-managed lands. Like amphibians, reptiles are closely tied to microhabitat conditions such as slope and aspect.

Birds

The Migratory Bird Treaty Act of 1918 as amended in 1972 makes it unlawful to "take" any migratory bird, any part of a bird, or nests and eggs of such birds (see Appendix C). The Bald Eagle Protection Act also makes it unlawful to "take" any bald or golden eagle, any part, or nests and eggs of such birds.

Song Birds and Upland Game Birds. In recent years public concern for these birds has risen sharply as a result of population declines. Rich and Beardmore (1997) list 177 species of birds that rated a priority for management attention in one or more of the western states (Appendix F). Federal lands in the western United States constitute an important part of breeding habitat.

Survey data have revealed declines in songbird populations throughout the United States, Canada, and Mexico. Population declines are due to a variety of factors. The main cause is habitat destruction on breeding grounds, wintering areas, and migration routes. But other significant factors include the following:

- Urbanization.
- Habitat fragmentation.
- Predation by domestic cats.
- Parasitism by brown-headed cowbirds.
- Flying into transmission towers and windows.
- Invasions of nonnative plant species.
- Herbicides and pesticides.

Songbirds that breed on public lands can be classified as short-distance migrants, residents, or long-distance (neotropical) migrants. Short-distance migrants may move only slightly, such as shifting elevation. For example, white-breasted nuthatches, mountain chickadees, and American dippers move down in elevation during winter and return to higher elevations in the spring and summer. Other species such as the northern mockingbird, rufous-crowned sparrow, and downy woodpecker may migrate south but remain within the United States during the winter. Resident birds generally remain in one area during the year and do not migrate. The hairy woodpecker, common flicker, horned lark, and black-capped chickadees are examples of residents.

Neotropical migratory birds fly to Mexico, the Caribbean, and Central and South America during the fall to spend the winter. They then return to the United States and Canada during the spring to breed. Neotropical migratory songbirds are some of the most beautiful and commonly recognized birds in the United States. Riparian areas and large tracts of upland native prairie are especially important to songbirds. Some familiar species of migratory birds in the West include the Bullock's oriole, western tanager, rufous hummingbird, lazuli bunting, cedar waxwing, and yellow warbler.

A variety of upland game birds also inhabit public lands. Several are becoming imperiled: sage grouse, Columbian sharp-tailed grouse, mountain quail, and lesser prairie-chicken. The U.S. Fish and Wildlife Service has received petitions for federal listing of each of the these species as threatened or endangered. Other upland game birds on BLM-managed lands include the ruffed grouse, blue grouse, greater prairie-chicken, California and Gambel's quail, willow and white-tailed ptarmigan, several dove species, and wild turkeys. Ring-necked pheasants and chukar partridge are both exotic upland game birds introduced from Eurasia.

Upland game birds occupy many plant communities managed by BLM. Sage grouse occupy habitats that are predominantly sagebrush steppe. Sharp-tailed grouse prefer a prairie or low- shrub and grass community. Ruffed grouse use brushy woodlands along streams and around springs. Their daily and seasonal habitat needs are typically more specific. Brood rearing requires wet meadow habitats and other habitat types that are ideal for producing forbs and insects.

Nationally, populations of greater prairie chickens, Alaskan sharp-tailed grouse, and wild turkeys are increasing. The remaining species are almost evenly split between stable and declining status. Although weather plays a major role in the population dynamics of upland game birds, urbanization and industrialization have eliminated millions of acres of habitat. Farming, grazing, logging, fire, mineral and energy development and nonnative plant invasions have all contributed to the loss of habitat.

Waterfowl. Waterfowl include ducks, geese, and swans. Most waterfowl breed in Canada, Alaska, and the northern United States and migrate to overwinter in Mexico and the southern United States. Important for the reproductive success and survival of waterfowl is a complex of diverse wetland habitat types that include a variety of emergent vegetation and open water areas.

Regardless of the habitat type, extensive areas of habitat have deteriorated or been destroyed and rendered unsuitable for waterfowl. Many waterfowl species have suffered as a result of shrinking habitats, exacerbated by long periods of drought combined with predation. Habitat losses have concentrated waterfowl populations and contributed to the rapid spread of mortality from diseases such as avian cholera and botulism.

Water quality affects the aquatic food chain and has major effects on waterfowl productivity. For example, increasing wetland acidity reduces both emergent vegetation and invertebrate diversity and biomass.

Shorebirds and Wetland-Dependent Migratory Birds. Shorebirds are found not only in coastal regions but throughout the Great Plains and deserts of the western United States–areas that have high evapotranspiration rates. Most shorebirds nest on the arctic tundra, including millions of pairs on public lands in Alaska. Shorebirds generally nest in upland grasses or gravelly areas near semipermanent to permanent wetlands and feed on invertebrates using mudflats exposed by receding water. Common shorebirds include sandpipers, plovers, killdeer, herons and egrets, phalaropes, avocets, rails, dowitchers, and willets. Loons, coots, and grebes require permanent wetland habitats. As with waterfowl, wetlands are important to the future populations of these species.

Raptors. Eagles, hawks, falcons, owls, and vultures are collectively known as raptors, or birds of prey. Compared to most other animal groups, raptors naturally exist at relatively low population levels and are widely dispersed within their habitats. Like the wolf, mountain lion, and grizzly bear, raptors are top predators and represent key species for determining the condition of a variety of ecosystems. Changes in raptor status typically reflect the availability of their prey species (mammals, birds, reptiles). Population changes also may suggest environmental conditions.

Raptors are a subgroup of land birds (see above) but have several special considerations. First, they are more sensitive to disturbances around their nests than are other landbirds because raptor territories are large and their populations are much smaller than those of other landbirds. Second, raptors are susceptible to direct mortality through both electrocution and shooting. Finally, because raptors are at the top of the food chain, they tend to be more vulnerable to contaminants. This vulnerability is related to higher levels of exposure due to bioaccumulation or biomagnification of some contaminants.

Small Mammals

Small mammals (rodents and insectivores) inhabit almost every kind of habitat in North America. Some species, such as deer mice, are common and widespread in many habitats. Others are found only in certain parts of the country or in limited, specific habitats. Beaver are a habitat-limited species because they require riparian or other aquatic communities. Rodents and insectivores are a major source of food for such predators as bobcat, coyote, fox, and badger, and are ecologically important to plant communities. Land uses that threaten one small- mammal species may benefit another.

Bats

Although information on bat species and populations on BLM-managed lands is limited, general studies and surveys are quickly filling this void. The involvement of Bat Conservation International through an agreement with BLM (March 1993) has significantly increased the knowledge base.

Bat populations are declining throughout the United States as a result of deforestation, agricultural development, and human disturbance of caves. Although people generally associate bats with caves, bats may occupy a variety of habitats, including trees and cliffs. Many bats have occupied abandoned underground mines, which often provide microhabitats similar to caves.

Declines in bats pose serious ecological and economic impacts. Bats are the main predators of vast numbers of nocturnal insects, which include many agricultural and forest pests. Bats are also important pollinators and seed dispersers for southwest desert plants. The Western Bat Working Group (1998) developed a matrix of regional priority species (Appendix F) to give states, provinces, federal land management agencies, and interested organizations better information on the overall status of bat species in western North America.

Carnivores

Populations of large carnivores are decreasing (Weber and Rabinowitz 1996; Clark and others 1996a, 1996b; Noss and others 1996). Large carnivores such as grizzly bears, gray wolves, mountain lions, wolverines, and coyotes are some of the most persecuted of all North American wildlife. Large carnivores have large home ranges and require large prey populations. Therefore, they require large, intact ecosystems to meet their general habitat requirements. One land development action, like clear cutting or a housing development, may only slightly affect a large-carnivore population, but the cumulative effects of multiple actions can be extremely harmful.

Carnivores can be either habitat generalists or habitat specialists. Larger species tend to use a variety of habitats. For example, mountain lion, coyote, black bear, and grizzly bear (habitat generalists) are tied to the movements of ungulates, berry production, and spawning runs of fish, and are therefore better adapted to changing environments (habitats). American martens and fishers (habitat-limited carnivores) require late-successional coniferous forests. River otter and mink depend on riparian habitats.

Predator populations are known to increase and decrease in response to prey availability. For example, a lynx's diet consists mainly of snowshoe hares. Snowshoe hares have a 9-to10-year cycle. Consequently, lynx populations peak every 9 to10 years with a lag year between the time that hare populations decline and lynx realize the declines. The relationship of prey base availability to carnivore populations is one of delicate balance.

Ungulates

Federal public lands are home to millions of big game animals, including large grazers such as elk, moose, mule deer, white-tailed deer, bison, bighorn sheep, woodland and barren-ground caribou, pronghorn antelope, and mountain goats. These native ungulates are important for recreation and subsistence hunting, as prey for large carnivores, and as a reliable source of carrion for scavengers. Like other wildlife, wild ungulates are affected by natural disturbances and human activities.

Threatened, Endangered, Proposed, and Candidate Species

Economic growth and development by a growing human population have depleted the habitat of many species to the extent that they are threatened with extinction. Enacted to conserve threatened and endangered species and the ecosystems on which they depend, the Endangered Species Act of 1973 (Appendix C) separates species into four listing categories:

- **Endangered species** are species in danger of extinction throughout all or a significant portion of their range.
- **Threatened species** are those likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
- **Proposed species** are those for which a proposed rule to list as endangered or threatened has been published in the *Federal Register*.

Table 3-26. Numbers of Federally Endangered, Threatened, and Proposed Species on BLM-Managed Lands *

ESA Listing Category	Endangered	Threatened Endangered	Proposed Threatened	Proposed	Total
Mollusks	8	4	0	0	9
Arthropods	7	5	1	0	13
Resident Fish	40	17	4	0	61
Anadromous Fish	5	9	0	3	17
Amphibians	3	1	0	0	4
Reptiles	2	7	1	0	10
Birds	11	11	1	1	24
Mammals	18	5	2	2	27
Plants	51	34	17	18	120
Total	145	90	26	24	285

Source: Data compiled from BLM field offices by the BLM Washington Office.

*Includes all BLM-administered lands, not just the EIS study area.

- **Candidate species** are taxa for which the U.S. Fish and Wildlife Service or the National Marine Fisheries Service has on file enough information on biological vulnerability and threats to support issuing a proposed rule to list but where further action is precluded by higher priority listing.

According to reports from BLM field offices and information compiled by BLM's Washington, Office, 285 species of plants and animals proposed or listed as threatened or endangered under the Endangered Species Act occur on land administered by BLM (Table 3-26). Public lands in each of the 11 western states are managed through state directors and field office managers. The number of proposed and listed species on public lands and acres open to location under the Mining Law within each state are summarized in Table 3-27. Appendix F includes a listing of species on all BLM-administered land compiled from field office reports.

Table 3-27. Acres of Public land Open to Location under the Mining Law, and Number of Species on Public Land Protected by the Endangered Species Act

State	Acres[1] (millions)	Number of species on Public Land that are Federally Proposed (P) or listed as Threatened (T) or Endangered (E) Under the Endangered Species Act					
		Plants			Animals		
		P	T	E	P	T	E
Alaska	86.5	0	0	0	1	4	1
Arizona[2]	13.6	0	5	10	0	9	27
California	9.1	2	15	24	5	17	29
Colorado	7.3	1	4	5	1	8	14
Idaho	11.2	0	4	0	0	9	12
Montana	6.1	0	0	0	1	5	8
Nevada	47.7	0	7	2	1	8	20
New Mexico	12.4	0	4	7	1	9	20
Oregon/Washington	13.4	0	6	9	3	20	17
Utah	21.1	0	11	7	1	6	12
Wyoming	15.2	2	1	0	1	5	14

[1] Approximate acres of public land open to mining from Table 1-4 in *Public Land Statistics 1999* (BLM 2000a). columns 5 and 6 were subtracted from the Grand Total Column to determine acres open to mining.

[2] The 1,635,000 acres for the Barry M. Goldwater air Force Range (Hempel 1999) were subtracted from Column 6 before determining acres open to mining.

In addition to species listed under the Endangered Species Act, many state wildlife agencies have their own lists of threatened, endangered, or sensitive species. Through policy, BLM manages public lands to conserve federally and state-listed species. Furthermore, BLM state directors are responsible for establishing lists of special status species that occur on public land and for carrying out programs and actions that conserve these species and prevent the need to list them as threatened or endangered under the Endangered Species Act (IM #97-118). According to BLM policy, approved land use must not contribute to the need to list species as threatened or endangered. Species proposed for federal listing as threatened or endangered and proposed critical habitat are to be managed with the same level of protection provided for threatened and endangered species, but formal consultations are not required.

Effects of Mining on Wildlife

Habitat Loss. Habitat loss is one of the main threats to maintaining wildlife diversity and species richness (Wilcove and others 1998; Fahrig 1997; Soulé 1986). All mining results in the loss of habitat at some time and for varying lengths of time (depending upon reclamation). Mining causes short- and long-term impacts to nesting, forage, and thermal and migration cover on mining sites until the disturbed habitats are returned to a condition suitable for a particular species and life stage.

Ireland and others (1994) studied the recolonization of wildlife on a coal strip mine in northwest New Mexico and reported that some habitat that existed before mining was being replaced by reclamation on the Pittsburg and Midway Coal Mining Company's McKinley Mine. Wildlife species selected for study in the newly created habitat included amphibians, reptiles, small mammals, and arthropods.

Vegetation composition and the presence of rocks were determined to be important components for some wildlife species, particularly habitat specialists. Slow regeneration of pinyon and juniper may have excluded some species for decades after mining. Although the study was conducted on a coal mine, similar results would be expected for other surface mining.

Several waterfowl species are apt to occur in any given area or habitat. Because most of these species have distributions that are wide relative to any single mining activity, single actions are generally not likely to noticeably reduce their populations. But the cumulative impact of multiple mines could have significant effects, especially if those effects occur in isolated geographic areas and vegetation types that are population sources for a given species.

Actual or potential degradation of any riparian or wetland area is a serious concern for shorebirds and other wetland-dependent migratory birds, even on a site no larger than a few acres. Even more so than for waterfowl, shorebirds tend to form large aggregations during spring and fall migration. At these times, significant proportions of entire populations may be in one small area (e.g. on only a few acres), where they are vulnerable to harm from contaminated soil or water. Locations used by migratory flocks may vary from year to year, depending on local, regional, and national climatic fluctuations. Large numbers of birds might unexpectedly visit any site with the proper general characteristics.

Mining's destruction of the wetland habitats of waterfowl, shorebirds, and wetland-dependent migratory birds can and are being mitigated to an extent by creating mine-associated wetlands. In a study of emergent wetlands on surface coal mines is Illinois, Horstman and others (1998) and McKinstry and Anderson (1994) reported that mine-associated wetlands with persistent hydrology and large expanses of emergent vegetation may provide habitat to compensate for the loss of natural wetlands.

According to Braun (1998), the developing of open pit mines harms sage grouse numbers and habitats in the short term. But several studies (Montana, Wyoming, Colorado) found some recovery of sage grouse populations after the initial development through the completion of reclamation (Eng and others 1979; Tate and others 1979; Colenso and others 1980; Scott and Zimmerman 1984, Braun 1986). Despite this positive note, Braun (1998) stated that no evidence to date suggests sage grouse populations attain their previous size. A population may need 20 to 30 years to reestablish.

Call (1979) observed that mineral development destroyed raptor nest sites, roost sites, and primary feeding areas. Measures for mitigating loss of raptor habitat have included creating artificial nests, relocating nests, and the retaining highwalls created by mining as new habitat (Postovit and Postovit 1987; Holthuijzen and others 1990).

Abandoned underground mines have become key year-round resources for bats. Due to the colonial nature of most bats, bats are especially vulnerable to the altering or closing of old mines. Loss of a single mine hibernation site can affect a multistate region, eliminating many summer colonies of bats over thousands of square miles.

Contemporary mines are usually in historic mining districts and can have major effects on bats. New sampling methods, such as drilling, may detect ore deposits missed by previous miners, and the ore is typically extracted by open pit mining. Open pit mining often destroy existing adits and shafts. Even exploratory drilling can greatly harm bats if it collapses mine entrances or underground workings (Tuttle and Taylor 1994; Idaho State Conservation Effort 1995).

BLM has demonstrated its commitment to protecting bats and their habitat during a Plan of Operations amendment at the Marigold Mine near Battle Mountain, Nevada. The Plan amendment review revealed that potential impacts to bat habitat were likely (JBR Environmental Consultants, Inc. 1997). A later survey found five species of bats using old mine workings, three of them BLM-listed sensitive species. A mitigation plan was developed. The plan required the company to avoid the impact altogether, minimize impacts by conducting temporary exclusion, and designate more existing habitat for rehabilitation and protection by installing protective gates.

Direct loss of habitat for big game, including both ungulates and carnivores, is an important issue when examining the impacts of surface mining. Habitat loss translates into a loss of forage and protective cover for animals. Ungulates, in particular, are closely tied to three basic habitats: summer range (calving areas), winter range, and migration corridors (Kuck 1986).

Research at a southeast Colorado military training area demonstrated the effect of habitat losses and alterations. Shaw and Diersing (1990) noted that pinyon-juniper and shrub vegetation densities were significantly reduced following military training. Grass species composition also shifted from perennial to annual vegetation, and the amount of bare ground increased. Stephenson and others (1996) found that these habitat alterations influenced mule deer movements.

Researchers (Kuck 1986; Merrill and others 1994) have proposed management recommendations to reduce the effects of mining on big game and large carnivores:

- Minimize habitat loss at mine sites.
- Avoid impacts to migration corridors.
- Protect critical habitats, such as wintering and calving areas.
- Decrease harvests by reducing human-wildlife encounters.

Where mining facilities are built, covered corridors, travel fences, and underpasses and overpasses should be installed to facilitate movement through the mine site (Merrill and others 1994; Noss and others 1996).

Habitat Fragmentation. Habitat becomes fragmented when a large expanse of habitat is transformed into a number of smaller patches. Two components of habitat fragmentation are (1) reduction in total habitat area and (2) redistribution of the remaining area into disjunct fragments (which mainly affect dispersal and immigration rates) (Wilcove and others 1986; Fahrig and Merriam 1994; McCarthy and others 1997). Fragmentation threatens the stability and persistence of wild populations because the size and isolation of remaining habitats increase the probability of extinction through demographic, environmental, or genetic randomness (Wolff and others 1997).

Sage grouse and other sagebrush obligate species are finicky toward habitat alterations because they so heavily depend on sagebrush. Fragmentation of habitat harms sage grouse if large openings (fragmented habitats) are created during mining. Braun (1998) found that openings larger than 150 to 200 meters would generally preclude use by sage grouse because they prefer to forage within 50 to 100 meters of escape cover. The environmental consequences of mining may be mitigated in part by mechanically treating alternative areas to provide suitable brood habitat on summer ranges.

Habitat fragmentation from mining includes the building of roads and structures. Roads directly and indirectly affect wildlife by doing the following (Young 1994):

- Impeding horizontal and vertical migration or dispersal.
- Subdividing populations that were previously connected.
- Increasing edge habitat.

Road placement and design are key elements to address for protecting and conserving wildlife. Braun (1999) reported that important sage grouse habitat has not been considered in establishing many roads (for mining and other uses) and that, therefore, roads commonly transect brood habitat, winter habitat, and migration corridors. Increased traffic may increase wildlife deaths. Roads also increase disturbance caused by human presence and activities, making highly visible wildlife species more vulnerable to harvest and harassment (Cole and others 1997; Stussy and others 1994).

Edge Effects. The creation of edge–the interface between adjoining plant community types–benefits some wildlife species. Many species are not adapted to edge habitats, and some are harmed. Road-edge habitats are hard-edged compared to natural edges, which tend to be soft-edged. Natural edges are less well defined, with vegetation types merging gradually from one community type to the other. But road edges tend to be abrupt, long-term, and more often disturbed. Road building increases air pollution, soil erosion, noise, direct vehicular fatalities, disturbance by human activities, and exotic species introductions. When combined, these factors create adverse habitat situations for many native species (Reed and others 1996).

Brown-headed cowbirds provide a good example of how one species may benefit and another be harmed by the creation of edge habitat. These birds are brood parasites that lay their eggs in the nests of host species. Cowbirds prefer edge habitats such as woodland edges (Lowther 1993). They have experienced a large expansion in range due to the creation of more edge habitats with road building and other habitat fragmenting. Cowbirds can seriously reduce the reproductive success of other species, particularly those with small populations (willow flycatcher, black-capped vireo, least Bell's vireo).

Predators that benefit from human activity (e.g. raccoons, coyotes, blue jays, crows, opossums, and feral cats) also tend to use edge habitats as foraging areas and often have a large adverse impact on bird populations (Robinson 1992; Robinson and others 1995; Robinson and others 2000).

Stress and other Disturbance Factors. Disturbance may physiologically and physically stress wildlife (Gabrielsen and Smith 1995). Ultimately, these responses may lead to increased mortality and decreased reproduction (Stephenson and others 1996). Two time periods are critical for many bird and mammal species: the immediate postnatal period in mammals and the breeding period in birds.

Noise. Mining inherently creates noise. Noise affects wildlife in a generally negative way (Shaw 1978). Signal detection would be reduced in areas in which human-generated noise is likely to interfere with acoustical signaling by wildlife (Shaw 1978). Disturbance may elicit physiological and physical responses in wildlife, as may the disturbance caused by noise (Gabrielsen and Smith 1995). But some wildlife species adapt to noise over time.

Potential impacts of disturbance to nesting raptors include the following (Fyfe and Olendorf 1976):

- Nest desertion.
- Damage to eggs or young caused by frightened adults.
- Overexposure of eggs or young to heat or cold.
- Missed feedings.
- Premature fledgling of young.

Call (1979) reported that frequent disturbance by mining can cause bald eagles to abandon their winter roosts or prevent them from using important feeding areas. The results of several raptor studies point to interspecific and intraspecific response differences, as well as differences by type of activity, season of year, and closeness to the disturbance (Bednarz 1984; Ramakka 1988; Holthuijzen and others 1990).

A variety of techniques have been employed to avoid or mitigate potential impacts to raptors (Ramakka 1988). Common recommendations include temporal restrictions of activities, selective road closures, or buffer zones around nests and roosts to prevent nest abandonment.

Bats are extremely vulnerable to disturbance. Entry to a winter bat roost during hibernation can trigger premature arousal and the depletion of fat reserves needed for winter survival. The disturbance of a maternity colony can cause mothers to abandon their young. The importance of such abandonment becomes apparent when considering that bats typically have one young per year. If an entire maternity colony is abandoned, the year's crop of young for that particular population would be lost (Brown and Berry 1991).

Mining on or next to water sources used by bats may impair the foraging abilities of bats. Bats use echolocation to find prey and maneuver. Mackey and Barclay (1989) examined the influence of physical clutter and noise on the activity of bats over water. Responses of bats varied by species, but the overall results suggested that both clutter and the increased background noise of running water reduce the activity of some bats by impeding the detection and capture of prey.

Responses of wild ungulates to disturbance, including the use of heavy equipment, vehicles, or human activities, may vary from subtle to extreme panic. Disturbance, therefore, may interfere with health, growth, and reproductive fitness of individual ungulates (Freddy and others 1986).

MacArthur and others (1982) examined cardiac and behavioral responses of mountain sheep to human disturbances (people afoot, people with dogs, different approach paths, road traffic, and air traffic) at the Sheep River Wildlife Sanctuary in southwest Alberta. A person approaching sheep with a leashed dog elicited the greatest response. Canids are the traditional predators of sheep, and it is not surprising that a dog would evoke an increased heart rate. Sheep also responded to the approach of humans from unexpected directions. Few reactions to road traffic were noted. MacArthur and others (1982) concluded that these mountain sheep were partially habituated to humans as a result of human visitation to the sanctuary but premised that sheep in less habituated populations would exhibit increased cardiac and behavioral responses.

Stephenson and others (1996) examined the response of mule deer movements to military activity. Mule deer increased their home range size in response to military training. Geist (1978) observed that animals in a largely predictable environment have a low reactivity to disturbances. Deer on the military site probably exhibited greater response to disturbance because training exercises were more random and unpredictable and tanks and other tactical vehicles were not restricted to roads.

Freddy and others (1986) found that mule deer were more disturbed by people on foot than by vehicles (snowmobiles). Responses to humans were longer and involved running more often, resulting in greater energy expenditure. As one would predict, mule deer response depended on the closeness of the disturbance to the deer.

Kuck and others (1985) examined the response of elk to simulated mine disturbance in Idaho. Elk calves subject to human disturbance and to simulated mine noises showed significant responses by altering habitat use and movement. Elk responded to levels of disturbance by interposing topographic barriers between themselves and the disturbance. The increased energy costs of movements, escape, and stress caused by these frequent and unpredictable disturbances may be detrimental to elk calves.

A serious consequence of persistent disturbance would be withdrawal of animals to marginal habitats where survival and productivity would be expected to diminish. Extrapolating from these studies, one could conclude that ungulates within the study area would be highly likely to respond similarly to mining. The mitigation measures discussed for habitat loss and fragmentation would help reduce the effects of mining-related disturbance.

Introduced Species. Introduced (nonnative or exotic) species evolved elsewhere and have been transported and purposefully or accidentally disseminated by humans. These species disrupt the functioning of native ecosystems. Most exotics become pests by rapidly dispersing into communities in which they have not evolved and by displacing native species (Li 1995). Many noxious weeds thrive in disturbed areas where they may out compete native vegetation and form monocultures of invasive species (Soulé 1990). When established, weeds may destroy thousands of acres of valuable wildlife habitat, making an area unsuitable for habitat-specific species.

Pollution. Cyanide is used in mining operations for the extraction of gold and silver from ores because of its strong tendency to form complexes with metals. Cyanide is a general respiratory poison, but uptake of cyanide can also occur through ingestion or exposure to the skin. Cyanide is a potent and rapid-acting asphyxiant. It can produce reactions within seconds and death within minutes. Cyanide acts rapidly in aquatic systems, but it does not persist for extended periods.

Cyanide is also highly species selective in its effects on organisms, including fish, birds, plants, and mammals. Cyanide inhibits ion transport mechanisms in amphibians. Wiemeyer and others (1986) found marked differences in toxicity of cyanide among species of birds. Study results found that species sensitivity to cyanide is not necessarily related to body size but to diet. Birds that feed predominantly on flesh were more sensitive to cyanide than species that feed on plants.

A variety of studies examined toxicity levels of cyanide on wildlife (Clark and Hothem 1991; Henny and others 1994). In one study of cyanide extraction in gold mines in three states (AZ, CA, NV), rodents and bats respectively accounted for 35% and 34% of total mortality. Ten mammal species that are endangered, threatened, rare, protected, or of special concern (lesser long-nosed bat, long-tongued bat, spotted bat, pika, Mojave ground squirrel, wolverine, California leaf-nosed bat, Townsend's big-eared bat, pocketed free-tailed bat, and badger) were documented mortalities (Clark and Hothem 1991).

Before the existing 3809 regulations were implemented, toxic concentrations of sodium cyanide, free cyanide, and metal cyanide complexes were readily accessible to a variety of wildlife. Wildlife died where cyanide solutions were open, such as in storage ponds, puddles on top of heaps, or flows in channels along the base of a heap to a pond. Most of the mortality was thought to be an acute response to ingestion of free or metal-bound cyanide. But inhalation and exposure to the skin were more important to aquatic species.

Since the 3809 regulations have been in effect, many studies have focused on the effects of heap leach solutions and mill tailing ponds on migratory birds. Birds are especially vulnerable during migration, when large populations are concentrated on limited habitat.

This vulnerability was demonstrated in 1988, when 1,459 migratory birds were killed at a gold mine (FWS 1990).

Nevada reported that during the mid-1980s more than 9,500 birds, mammals, reptiles, and amphibians were found dead at mill tailings ponds and heap leach operations (Henny and others 1994b); 91% of the deaths consisted of birds, mainly waterfowl, shorebirds, and gulls. In 1989 Nevada passed a wildlife law that developed a program through its artificial pond permitting to require industry to report wildlife mortalities and protect these resources.

More recently, wildlife mortalities at mine sites in Nevada have decreased dramatically, from more than 2,000 individual animals in 986 to just over 300 in 1993 and 1997 (Molini 1998). To break these numbers down even further, less than 50% of these mortalities in 1997 were caused by contact with permitted facilities (cyanide ponds or the nets and fences that cover them). A nearly four fold decrease in the number of bird mortalities has been estimated for the 7-year period (Molini 1998).

Mine operators have begun to apply methods of protecting vertebrates from mine water poisoning by the following methods:

- Using netting and plastic sheeting.
- Applying dilution techniques to reduce cyanide concentrations.
- Making collection channels inaccessible to wildlife (Canter and others 1991; Henny and others 1994b).

A letter from the Nevada Division of Wildlife (Molini 1998) to "Interested Party" reported that wildlife mortality data show a substantial decline in all categories of animals except for a small increase in the number of waterfowl. The letter goes on to state, "Overall, wildlife mortalities associated with permitted facilities were down to the second lowest level recorded in the past ten years, 185 individuals." Although proven techniques exist for mitigating impacts to wildlife, some mines continue to use less effective techniques such as hazing, noise makers, and colored flagging (Clark and Hothem 1991).

Powerlines. Powerlines for mining may both benefit and harm wildlife. Powerlines may benefit raptor species by providing roost sites, nest sites, and prey surveillance. Conversely, these same powerlines may electrocute raptors or kill them when they crash into poles (Bevanger 1994; Faanes 1987). The following avian groups have been represented in counts of dead birds at powerline poles: waterfowl, gulls, cranes, shorebirds, rails and coots, cormorants, blackbirds, grebes, grouse, pelicans, raptors, doves, herons, woodpeckers, and other passerine birds. Although none of the mortality was considered to be biologically significant (Faanes 1987), the cumulative effects of mortality may be important to populations of rare or endangered species.

Bevanger (1994) reviewed published reports on powerlines. Storks, falcons, owls, and passerine birds were the most often reported victims of electrocution. Cranes, pelicans, storks, and grouse deaths were reported in excessive numbers from flying into these lines. Bevanger also points out that, although information is lacking to show that utility structures are a significant cause of death, powerlines are a serious cause of mortality for some listed species (whooping crane, peregrine falcon, Mexican spotted owl, northern spotted owl, brown pelican, wood stork). The above studies did not state whether these powerlines were for mining but are simply compilations of reported mortalities.

Netcher (1998) estimated that only about half of mines have powerlines. For mines with powerlines a variety of mitigation measures can be used to reduce electrocutions, including new power pole designs and modifications (Postovit and Postovit 1987). Three categories of modifications can mitigate powerline impacts:

- Designing and modifying poles, crossarms, and conductor placement to adequately separate energized parts.
- Insulating wires and other hardware where separation is impossible.
- Managing raptor perching.

Wildlife may be harmed by raptor use of utility structures for hunting. Sage grouse are heavily affected by raptor predation. Braun (1998) reported that sage grouse numbers and use increase as distance from the powerlines increase.

State Wildlife Protection Statutes

According to the Center for Wildlife Law and the Defenders of Wildlife (1998), state endangered species act provisions exist in 9 of the 11 study area states (see Appendix D). Utah and Wyoming are the exceptions, but they both have provisions for protecting wildlife. For the nine states with endangered species laws, all are dated between 1969 and 1976. California and New Mexico are the only states to require recovery plans. California and Oregon are the only states that require consultation for state-listed species. Despite the efforts of each state, few state acts provide effective programs for protecting threatened and endangered species.

Historically, states were given the role of protecting the wildlife within their borders. State governments have traditionally served as the stewards of wildlife. Today, they retain this responsibility, but the Federal Government has assumed primary responsibility for species protected by the Endangered Species Act (Center for Wildlife Law and the Defenders of Wildlife 1998).

Environmental Consequences

Impacts Common To All Alternatives

Direct Effects. Disturbances may benefit some species while harming others. Disturbance of habitat always causes short-term impacts and may cause long-term impacts, depending on the following:

- Length of time before reclamation prescriptions are applied to a site.
- Length of time for vegetation to become established.
- The suitability of vegetation to fulfill species-specific habitat requirements.

Indirect Effects. Indirect impacts of mineral activities would generally be those that do not occur immediately. Indirect effects can occur to the area directly affected by the mineral activity or to an adjacent area. Such effects could include loss of habitat or degraded habitat condition for proposed or listed species from the long time frames required for site reclamation.

Public access to mined areas is expected to increase because of the attraction created by mining and the building of new roads.

A significant percentage of the unimproved and sometimes improved roads on public lands have resulted from the direct and indirect effects of mining since the passage of the Mining Law. Thus, route proliferation and habitat fragmentation become issues when they affect proposed and listed species and proposed and designated critical habitats. Increased vehicular access might result in new and sustained impacts to ecosystems that support proposed and listed species. In some cases, the disturbance to proposed and listed species might be greater than during mining because of the diversity of activities allowed by access (exploring, shooting, hunting, collecting, camping).

Through the land use planning process, BLM will address vehicle use management and designate lands as open, limited, and closed to off-road vehicle (ORV) use. Another category–undesignated–allows for unlimited vehicle use pending a final decision. Most of the public lands are in an open or undesignated category for ORV use. These designations are expected to change through land use planning decisions and a new effort by BLM to manage ORV use to protect natural and cultural resources. Threatened or endangered species issues caused by ORVs during casual use are directly related to the adequacy of decisions under the ORV regulations (43 CFR 8340) rather than to the surface management regulations (43 CFR 3809).

Alternative 1: No Action

Notice-level activities would continue under the existing regulations. Because they do not constitute federal actions, such activities do not require Section 7 consultation under the Endangered Species Act (ESA). Section 7 requires federal agencies to ensure that their actions (including permitting) are not likely to jeopardize the existence of a listed species (plant or animal) or destroy or modify critical habitat. Without consultation, it is difficult to prevent or mitigate harm to threatened and endangered species. Therefore, No Action presents a potential for the taking of threatened or endangered species.

Financial guarantees are not required for Notice-level operations under the existing regulations, and some operators might abandon their operations without reclaiming them. Since 1981, failure to reclaim has accounted for about 67% of all notices of noncompliance. Where sites are not properly reclaimed or not reclaimed in a timely manner, wildlife habitat would continue to be lost, fragmented, or otherwise degraded.

Casual use is not subject to agency notification. Without notification, BLM cannot determine if the casual use might harm threatened or endangered species. Even though casual use involves minimal surface disturbance, cumulative disturbance has caused harm. In one case digging for dry placers by a recreational mining club left open holes large enough to trap desert tortoises. Harm might even result from a single incident of casual use such as digging with hand tools where an endangered species is confined to a single location at a unique seep or spring.

Alternative 2: State Management

Regulations would vary by state under Alternative 2. Without a set of comprehensive federal regulations, the overall protection and restoration of wildlife and habitat would decrease. Alaska, Arizona, and Nevada do not require permits for operations disturbing less than 5 acres. Idaho requires documentation of activities for exploration involving less than 5 acres, but not until after the activity has ended. Without notification, it would be difficult for state agencies to protect wildlife and their habitats and enforce reclamation.

Under Alternative 2 weed control would depend on state and local efforts. The lack of a comprehensive policy would likely increase the potential for infestations. An increase in the spread of weeds would harm biodiversity, habitat quality, and ecosystem functions, and have the potential to decrease native wildlife populations.

Mineral operations under Alternative 2 would no longer consist of federal and would not be subject to consultation under Section 7 of the Endangered Species Act (ESA). Section 7 requires federal agencies to ensure that their actions (including permitting) are not likely to jeopardize the existence of listed plant or animal species or destroy or modify critical habitat. Without consultation, it would be much more difficult to prevent or mitigate harm to threatened and endangered species than under the existing regulations. Therefore, Alternative 2 would increase the likelihood of the taking of species.

Alternative 3: Proposed Action

The strengthened performance standards in Alternative 3 for vegetation, soils, wildlife, and riparian-wetland resources would result in better wildlife protection and habitat restoration and help maintain wildlife populations at present levels.

Under the proposed regulations, all mining and milling projects would require Plans of Operations, resulting in a more formal review and approval of activities. This added planning should promote better restoration of wildlife habitat than the existing regulations. In addition, all mining and milling would be federal actions and subject to consultation under Section 7 of the Endangered Species Act. The likelihood of operations taking endangered or threatened species would decrease.

Under Alternative 3, BLM would have more discretion in determining the types of impacts operators could cause. BLM could prohibit operations that would cause substantial irreparable and unmitigatable harm to significant resources. Given this discretion, Alternative 3 would help maintain population levels of threatened and endangered wildlife species at their current levels.

BLM could establish areas where operators must contact BLM before beginning their operations. BLM would then determine whether Notices or Plans are required. The provision was designed to protect wildlife, especially, threatened and endangered species, from the cumulative impacts of casual use's causing more than negligible disturbance. The required notification would better protect wildlife from unnecessary and undue degradation and help maintain population levels of threatened and endangered species at their current levels.

The Proposed Action would require reclamation bonds for all Notice-level operations. This financial assurance should prompt better compliance by operators than would the existing regulations in reclaiming and restoring wildlife habitat. Moreover, should the operator default, BLM would have funds to reclaim and restore wildlife habitat.

Under Alternative 3, inspections and monitoring of operations would become mandatory four times annually where cyanide is used or where acid rock drainage is occurring or might occur. Such monitoring and inspection would alert managers to potential wildlife hazards and decrease wildlife deaths from what would result under the existing regulations.

Alternative 4: Maximum Protection

Alternative 4 would require that vegetation on reclaimed areas be long lasting, self-sustaining, and comparable in diversity and density to the preexisting natural vegetation, and achieve 90% of the canopy cover of adjacent, undisturbed lands. Alternative 4 would also require that only native plants be used for revegetation. Riparian areas would also have to be restored to proper functioning condition within 10 years. These requirements would help restore wildlife habitat to conditions similar to or better than the preexisting plant community and would help increase the likelihood of maintaining population levels of wildlife species at their current levels.

Alternative 4 would eliminate Notices, and all projects causing more than negligible disturbance would require Plans of Operations. This change would result in a more formal review and approval of activities. The added planning should promote better wildlife habitat restoration than would the existing regulations. In addition, all projects beyond casual use would be federal actions and subject to consultation under Section 7 of the Endangered Species Act, resulting in a decrease in the likelihood of the taking of endangered or threatened species.

Under Alternative 4, operators could not jeopardize special status species and cause them to be listed as threatened or endangered.

Alternative 5: NRC Recommendations

Under Alternative 5, all mining and milling would require Plans of Operations, resulting in a more formal review and approval of mineral activities. This added planning should promote better restoration of wildlife habitat than would the existing regulations. In addition, all mining and milling would therefore be considered federal actions and subject to consultation under Section 7 of the Endangered Species Act. The result would be a decrease in the likelihood of the taking of endangered or threatened species.

Alternative 5 would require reclamation bonds for all Notices. This financial assurance should prompt better compliance by operators than would the existing regulations in reclaiming and restoring wildlife habitat. Moreover, should operators default, BLM would have funds to reclaim and restore wildlife habitat.

Cumulative and Residual Impacts to Wildlife Resources

In the first 17 years after the 3809 regulations went into effect in 1981, exploration and mining disturbed an estimated 214,000 acres of public lands. Projections for mineral activities over the next 20 years show that mineral operations under the existing regulations and alternatives would disturb as much as 183,000 more acres. The total surface disturbance on vegetation from past and reasonably foreseeable mineral activities over the final EIS period, therefore, would equal as much as 400,000 acres. This amount represents about 0.12% of the total acreage of public lands and Stock Raising Homestead Act lands administered by BLM within the study area (see Table 3-1). The cumulative impacts from mining and exploration on wildlife within the study area would therefore be limited.

Residual impacts on wildlife habitat would affect the 400,000 acres directly disturbed by mineral activities. As discussed in the vegetation and soil sections, mining usually changes the original soil profile, which ordinarily requires hundreds to tens of thousands of years to develop. Mining might therefore yield soil substrates that greatly differ from what was there before mining.

These differing substrates might affect the rate of succession or completely alter it. Different trajectories of succession are therefore possible, and this altered succession represents a loss of wildlife habitat that existed on the site before mining. Alternative 4 would require more of the soil profile to be salvaged than would the other alternatives, resulting in a better chance of establishing similar substrates able to support vegetation and wildlife habitat similar to what existed on a site before mining.

Wild Horses and Burros

Affected Environment

The Wild Free-Roaming Horse and Burro Act of 1971 requires wild horses and burros to be managed at proper management levels and prohibits their relocation to areas where they had not lived before 1971. One of the act's goals is to manage populations to create a thriving natural ecological balance on public lands. Proper management levels have not been set for all herd management areas but are estimated to be 23,500 wild horses and 3,600 wild burros.

In October 1997 about 37,600 wild horses and 5,400 wild burros inhabited some 200 herd management areas (HMAs) on federal land in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Wyoming. BLM manages HMAs whose populations exceed proper management levels to reduce populations by selective removals, including adoptions, fertility control, and natural mortality.

Normally, wild horses almost exclusively eat grasses. Burros have a more diverse diet of grasses, forbs, and shrubs. Wild horses and burros graze throughout their HMAs, including upland and riparian areas. Both wild horses and burros migrate short distances during seasonal movements.

The most critical time of year is in the spring during foaling. The social dynamics of wild horse herds, such as competition between stallions, causes dispersion. Wild burros tend to disperse as water becomes plentiful.

Environmental Consequences

Impacts Common to All Alternatives

Mines operating within herd management areas (HMAs) might harm wild horses and burros. Exploration and mining might reduce forage and restrict access to some water sources. Mine dewatering might also reduce water supplies. Increases in noise and vehicular traffic and the presence of humans in these areas might force herds to move to other areas. Horse and burro sensitivity to such activity would be most acute during spring foaling. Animal and human safety are also concerns, mainly along access roads that cross HMAs.

Alternative 1: No Action

Herds could be displaced by noise, vehicle traffic, human presence, or loss of forage or water sources. Water sources could be lost by restricted access or dewatering. Sensitivity would be most acute during spring foaling.

Alternative 2: State Management

Impacts under State Management would be the same as under the existing regulations.

Alternative 3: Proposed Action

Under Alternative 3 mining would have to comply with provisions of approved BLM land use plans, providing that compliance does not impair claimant rights under the Mining Law. In the foreseeable future, provisions could be added to land use plans to limit the amount, type, or timing of mining in HMAs. Affected wild horse and burro populations would benefit from limiting use of heavy equipment, drilling, blasting, and truck traffic within HMAs.

Alternative 4: Maximum Protection

Under Alternative 4 mining would have to comply with provisions of approved BLM land use plans. In the foreseeable future, provisions could be added to land use plans to limit the amount, type, or timing of mining in HMAs. Affected wild horse and burro populations would benefit from limiting use of heavy equipment, drilling, blasting, and truck traffic within HMAs

Alternative 5: NRC Recommendations

Under Alternative 5 mining would affect wild horses and burros much as would Alternative 1 but would have to comply with approved land use plans. Range resources would have more protection than under the Alternative 1 through the requirement of comprehensive Plans of Operations for all mineral activities except exploration and casual use.

Livestock Grazing

Affected Environment

Livestock grazing is one of the major land uses within the study area. BLM administers livestock grazing on federal lands under the authority of the Taylor Grazing Act. Other laws that govern livestock grazing on federal lands include the Bankhead-Jones Farm Tenant Act, National Environmental Policy Act, Federal Land Policy and Management Act, and Public Rangelands Improvement Act. BLM authorizes more than 9.4 million animal unit months (AUMs) of livestock forage on public lands in the study area (excluding Alaska) on 21,600 allotments covering nearly 161 million acres.

Since 1981, mineral activities on public lands have disturbed about 214,000 acres in the study area. Although we do not know how many AUMs of forage have been lost due to mining since 1981, an estimated 10,000 AUMs (0.1% of current AUMs authorized) have been irretrievably lost to mining on the basis of the following assumptions:

- Livestock consume 1 AUM for every 20 acres (161 million acres in allotments divided by 9.4 million AUMs).
- Livestock graze all acres in allotments.
- Livestock grazed all acres previously disturbed by mining.

These are restrictive assumptions that greatly overstate the likely actual impact because livestock do not graze all acres in allotments, livestock did not graze all acres previously disturbed by mining, and not all disturbance where grazing does occur results in a loss of AUMs. Nevertheless, this estimate gives a perspective on the general size of the impact.

Environmental Consequences

Much of the information in the following discussion was derived from the Stone Cabin Mine Final EIS (BLM 1994c). The impacts discussed would be common to all alternatives.

Impacts on livestock grazing from any of the alternatives could result from the following:

- Direct and indirect displacement of grazing.
- Conflicts with traffic.
- Blockage of livestock access.

These impacts would not generally be attributable to a single mine component but might result from the aggregate of all mine components and related activities.

Removal of vegetation during mine construction and operations would directly replace livestock grazing. In addition, a larger area would be affected where mine features are fenced. When mining operations are developed where livestock graze public land, BLM must sometimes reduce permitted use. Under these circumstances, grazing permits and leases are permanently adjusted, as provided for in the grazing management regulations. Generally, these reductions are not restored following reclamation of mining sites.

Mine developments would also directly or indirectly displace rangeland improvements. Fences separating grazing allotments and pastures might be disrupted. Fences would have to be realigned. Or new fences, cattle guards, or other devices would be installed to maintain the integrity of allotments, pastures, and ownership during all phases of mining. Without these steps, cattle from different allotments and pastures would mix. In addition, important livestock watering ponds, springs, and devices might also be degraded.

Airborne dust would likely reduce vegetation productivity and palatability downwind of and immediately next to mines and travel routes. But most dust generated would settle within fenced areas, reducing impacts on livestock.

Cattle displaced from mine developments would tend to concentrate in other preferred areas, most likely near water sources, including wetland and riparian areas.

Mine traffic is expected to increase, resulting in possible livestock losses and damage to vehicles.

Long-term impacts to grazing include direct displacement by unreclaimed or unsuccessfully reclaimed areas. Additionally, reclaimed acres could not be grazed for several growing seasons until grasses and forbs become established. In some areas grazing would never resume because permanent changes in topography could not accommodate livestock. Reestablishing grazing too quickly in these areas would endanger the success of revegetation by overgrazing susceptible young plants.

Until vegetation becomes established, these areas would provide only a fraction of the carrying capacity of similar undisturbed areas. Grazing would be further delayed on a portion of the revegetated areas because to become successful, some revegetation would probably need reseeding.

Fences and other range improvements would be restored to as close to premining conditions as practicable. Fences around mine features would be removed at some point after reclamation.

With closure and reclamation, all mining would cease. Therefore, some grazing might be restored, but, depending on the type of mining, grazing would not be restored to previous levels. Therefore, some forage losses would be irreversible.

For the most part, access through mined areas would be improved by the presence of mine roads that are not reclaimed. This improved access would increase recreational travel through mined areas. Some of the other access roads blocked by mines would also be reopened. New traffic would increase the probability of conflicts between livestock and people engaging in recreation. The effects of such conflicts cannot be reliably predicted.

Special Status Areas

Affected Environment

Special status areas are lands that BLM has determined have resources of unique or distinct value. These lands have a variety of designations, depending on the authority under which they were designated and the resources present. Some special status areas are open to mineral activity under the Mining Law or, if closed, contain mining claims that may have prior rights for mineral development.

Special status areas where exploration and mining are subject to the 3809 regulations include the following:

- Areas of critical environmental concern (ACECs).
- Lands in the California Desert Conservation Area (CDCA) designated as controlled or limited use areas.
- Areas in or designated for potential addition to the National Wild and Scenic Rivers System.
- Areas closed to off-road vehicle use.
- Designated wilderness areas.

Resources that contribute to the designation of these areas are diverse. Special status areas may be designated to protect a wide variety of resources, such as sensitive plants, wilderness characteristics, scenic vistas, geothermal features, or American Indian sacred sites. Special status areas may also be designated because of potential hazards such as abandoned mines or hazardous materials. The potentially affected resources in special status areas are some of the most valuable and significant resources found on BLM-managed lands. A comprehensive description of all resources in BLM special status areas would be exhaustive.

As of September 30, 1999, a total of 740 designated areas of critical environmental concern (ACECs) covered about 13.1 million acres of public land managed by BLM (BLM 2000a). Some of these ACECs are closed to activity under the Mining Law, or are closed but contain mining claims with prior mineral development rights. Other ACECs have been left open to the operation of the mining laws with the 3809 regulations used to manage mineral activity in concert with the ACEC resources.

There are 34 BLM-administered rivers in the National Wild and Scenic Rivers System with more than 2,000 river miles and 998,468 acres under protection (BLM 2000a). Some lands in the system are open for operations under the mining laws or have prior development rights that are subject to the 3809 regulations.

BLM manages 5,243,332 acres of wilderness in the United States (BLM 2000a). These areas are all closed to activity under the Mining Law, but some areas have mining claims with prior development rights under the mining laws. Mining activities in wilderness areas with prior development rights under the mining laws would be regulated by the 3809 regulations.

Environmental Consequences

Impacts to special status areas would depend on the impact to the particular resource that led to the area's nomination or designation. This discussion considers changes in the definition of what the regulations consider a special status area and standards the 3809 regulations provide for the resources within special status areas.

Alternative 1: No Action

The existing regulations require operations in the California Desert Conservation Area, in wilderness areas, and along wild and scenic rivers to meet the statutory level of protection or reclamation required by the establishing act. Impacts from operations in these areas can and have been conditioned to meet these requirements. This provision would continue to prevent impacts to resources in these areas as required by the areas' establishing authority. This provision would also preserve the resources that supported the areas' special status designation.

The existing regulations do not require a higher standard for resource protection in areas of critical environmental concern (ACECs) or areas closed to off-road vehicles (ORVs). Any mineral activity greater than casual use would continue to require an approved Plan of Operations. The Plan review and approval process would allow mitigation to be designed to protect resources in the special status area. But the performance standard is still based on the requirement to prevent unnecessary or undue degradation. There is no higher standard for environmental protection in these areas similar to areas designated by statute.

In the past this lack of higher standards has occasionally resulted in impacts to the resources that supported designation of the ACEC or ORV closure. These potential resource conflicts would continue to occur on a site-specific basis. In extreme cases the resources that resulted in ACEC designation could be significantly affected.

Alternative 2: State Management

The levels of protection or reclamation required by statute would continue to apply to some special status lands. State regulatory agencies would administer these requirements, but enforcing these requirements without BLM review and approval of individual Plans might result in some projects not meeting statutory requirements for resource protection.

Impacts to resources in ACECs or areas closed to ORV use would depend on the efficiency of the state regulatory programs and be highly site specific. Land use or activity plans would guide the states on special values of concern. But without BLM review and approval, the potential is likely to increase for mineral activities to harm resources in these special status areas.

Alternative 3: Proposed Action

The proposed regulations would continue to give the same level of resource protection to special status areas as designated by statute. Expanding the list of special status areas to include certain threatened or endangered wildlife habitat, national monuments, and national conservation areas would improve protection of sensitive resources. By requiring a Plan of Operations for activity that previously could occur under a Notice, the Proposed Action would add review times and analysis requirements that would likely improve protection of these resources.

The proposed performance standards would provide a tie to land use plans. This tie would result in specific consideration of the resources in special status areas and is likely to more effectively mitigate potential impacts to these resources.

The proposed regulations would reduce the potential for environmental impacts to resources in special status areas because of the following:

- More stringent performance standards (including the new definition of unnecessary or undue degradation).
- Plan review requirements.
- Predicted decrease in mineral activity.

But the potential remains for these areas to be affected if they are open to mineral activity. Should the proposed mineral activity be determined to constitute substantial irreparable and unmitigatable harm to significant resources, then BLM would deny the Plan of Operations. Such action is most likely to occur in special status areas because these areas were usually designated because of their significant or sensitive resources. The requirement to prevent substantial irreparable harm would give a high level of protection to resources in special status areas. Therefore, mineral development would not jeopardize the resources that led to the special status area designation.

Alternative 4: Maximum Protection

Alternative 4 would protect resources in special status areas designated by statute. Mandatory conformance with land use plans would prevent impacts to these areas. Land use plans would provide prescriptions to ensure that the resources that led to the special status area designation are not affected. In addition, the requirements to prevent irreparable harm to resources would allow BLM to preclude activities that would affect special status areas and their resources. Alternative 4 would give a slightly higher level of protection for special status areas than would the Proposed Action.

Alternative 5: NRC Recommendations

Alternative 5 would not expand the list of special status areas but would require a Plan of Operations for all mining. Certain areas that would have been special status areas under the Proposed Action, such as valuable wildlife habitat, national monuments, and national conservation areas, would still receive increased protection from mining through the Plan of Operations review process, but not from a change in performance standards. Exploration creating less than 5 acres of disturbance could still occur in these areas under Notices. But this provision is not likely to have a significant impact because of exploration's more limited disturbance size, duration, and reclaimability when compared to mining. In addition, the provision to bond Notice-level operations would assure reclamation of disturbance in these areas.

The existing performance standards and continued use of the existing definition of unnecessary or undue degradation under Alternative 5 would not preclude mining from significantly affecting some special status areas that are not protected by other legal authorities. Though such occurrences would be rare, if due or necessary for mine development, disturbance could significantly degrade the resources for which some special status areas were designated.

Recreation

Affected Environment

BLM manages public lands for a variety of recreation uses, including hunting, fishing, rock collecting, camping, sightseeing, hiking, winter sports, and off-road vehicle (ORV) use. Most recreation use depends on the natural and cultural features of the land. Public lands in the study area are renowned for their diverse scenic and visual resources. Generally good air quality and dramatic topography combine to create spectacular vistas. The popularity of scenic and backcountry byways and scenic overlooks illustrates the value and appreciation of scenic quality.

Federal lands have a growing number and diversity of visitors seeking recreation (Cordell and others 1989). On BLM-administered lands during 1996, recorded recreation use exceeded 72 million visitor days. Projections show that these numbers will continue to grow, particularly for camping, sightseeing, hiking, ORV use, and winter sports (Environmental Resources Assessment Group 1997).

At the same time, access to federal lands is an increasing problem in many western states, particularly where private lands must be crossed to reach federal lands. Access is being lost where ranches are bought for recreation and recreation homesites; ranchers lease their land to outfitters and close it to others; or ranchers are attempting to avoid vandalism, litter, or open gates.

Maintenance of recreational resources on federal land is important for "quality-of-life" issues. Research on the effects of participation in outdoor recreation show such benefits as improved physical and mental health, increased self-esteem, an enhanced sense of well-being, and spiritual growth. Participation in outdoor activities can also increase family interaction and foster cohesion. Benefits to communities include increased social solidarity, satisfaction with community life, and increased ethnic and cultural understanding (Cordell and others 1989). The same report also cites some of the major issues facing recreation today:

- Protecting resources and open space.
- Acquiring more land and water to meet expected demand.
- Resolving conflicts among diverse users.
- Addressing the need for more access to outdoor recreation areas.

An inventory of an area's wildland recreational settings based on its physical, social, and managerial attributes is the basis for the recreational opportunity spectrum (ROS). These attributes combine to produce recreation opportunities that have three components: an activity, a resource setting, and an experiential component. By combinations of these attributes, lands can be characterized by a continuum of recreational opportunity classes, including primitive, semiprimitive nonmotorized, semiprimitive motorized, roaded natural, rural, and urban.

Primitive settings have essentially unmodified natural environments. Their size and configuration assure remoteness from the sights and sounds of human activity. The use of motorized vehicles and equipment is not permitted in primitive settings except in extreme emergencies. Moreover, the user is forced to be self-reliant and expects to see few people.

At the opposite end of the continuum, urban settings have high levels of human activity and concentrated development, including developments for recreation opportunities. Urban settings also have a preponderance of signs and other indications of regulations on user behavior.

The opportunity classes serve as an inventory tool for current recreation conditions and visitor expectations. Because mineral development could lead to changes in these settings, opportunity classes serve as a useful measure to help describe the consequences of such development. (USFS 1990; Montana Dept. of State Lands and others 1992). Although most of the public lands have not been inventoried using the ROS system, the opportunities on public lands tend to fall toward the more primitive end of the spectrum (including primitive, semiprimitive nonmotorized, semiprimitive motorized, and roaded natural).

The effects of mining on recreation tend to be localized and depend on a variety of factors, including the size and type of mine, the mine's setting, the recreation activities occurring in the area, the experience derived from these activities, and opportunities for similar activities in other nearby areas. The following are examples of the types of effects that locatable mineral activities could have on recreation:

- Loss of recreational resources that might lead to displacement of the activity to alternative areas or loss of the ability to engage in the activity.
- Modification of recreation settings leading to changes in recreation experiences due to project-related activities or the presence of project-related facilities.
- Reduced feelings of solitude and remoteness due to the introduction of visual, sound, or other sensory effects from project-related activities that could conflict with recreation use.
- Changed access to the area, which could open the area to some uses and close it to others. For example, mine developments can reduce opportunities for nonmotorized recreation while increasing opportunities for motorized recreation.
- More local recreation by the local population that mine employment has increased.
- Potential effects to the regional ecosystem's health that could decrease opportunities to use these resources for recreation (BLM and USFS 1997).

Effects of mining on recreation can vary a great deal. The following examples outline potential effects to recreation from different types of mines under the existing regulations. More than 125,000 acres of public lands (of the study area's 262 million acres of public lands) are estimated to be currently disturbed by locatable minerals mining.

Impacts have the potential to be most severe when a large open pit mine is located in an area of high-quality, irreplaceable recreation. An example potentially severe impacts may be seen in the proposed New World Mine, which would have been located northeast of Yellowstone National Park and could have affected the prime recreation experiences in and near the park (BLM and US FS 1997). This mine will not be developed (this project was not on BLM- managed lands). But had the mine been developed, effects could have included the following:

- Changes to the recreation setting, including eliminating recreation at some sites and changing other settings by direct visibility of mining, which would eliminate feelings of remoteness and isolation.
- Changes in access, including new roads, increased traffic management, increased congestion, and blocked traffic.
- Changes in the sensory experience of backcountry users and others who are seeking a natural experience, including more noise, perception of increased congestion and crowding from mining-related traffic, and artificial night lighting.
- Effects to hunting and fishing where mining might alter wildlife patterns or fishing opportunities.

The following examples outline potential effects to recreation from a large open pit mine, a placer mine, and a bentonite strip mine under the existing regulations. These examples represent the types of impacts from mining on BLM lands.

The Bootstrap Project is an open pit mine in the Carlin Trend area near Elko, Nevada (BLM 1996c; Treiman 1998). Lands in the region provide diverse recreational activities, including fishing, sightseeing, hunting, cross-country skiing, white water rafting, photography, rock collecting, and off-road vehicle use. The Bootstrap Project is increasing the amount of land disturbed by mining and has resulted in less land for recreation. In addition, because much of the area next to the mine is being used for exploration, public access there has been restricted for safety and security reasons.

The Bootstrap Project area, however, is not intensively used for recreation and does not offer unique recreational opportunities. The region contains large areas of similar land open to the public for dispersed recreation. It is assumed that people can go elsewhere for a similar recreation experience outside the project area.

Recreation potential unrelated to mining is also changing in the region. Many land owners who allowed unrestricted access in the past have reacted to increased use and abuse by locking gates on their private lands, thereby restricting access to public lands. Some of the increased use may be the result of users displaced from areas affected by mineral exploration and mining. These losses could make it more difficult to replace the recreation activities lost to mining.

The Birch Creek Placer Mining Final Cumulative EIS (BLM 1988a, McClain 1998) discusses the potential impacts to recreation from placer mining in the Birch Creek watershed about 70 miles northeast of Fairbanks, Alaska. Birch Creek, a national wild river, is managed as a part of the Steese National Conservation Area. The national wild river offers outstanding recreational opportunities for floatboating for the experienced canoeist and is one of the few clearwater rivers in the state with road access at two points on an otherwise undisturbed river. In addition to floatboating, visitors to the area fish, hunt, study nature, observe wildlife, wilderness camp, and hike.

Placer mining has affected recreation in this area in a variety of ways. New mining roads have allowed access to new areas for off-road vehicle (ORV) use, with some trespass occurring in areas closed to ORVs. Boating and hunting have increased substantially in the past 15 years due mainly to better access. This increased use has reduced the quality of the primitive recreation experience. Degraded water from holding pond breeches and mining claims in the headwaters of Birch Creek during high water events have degraded the recreational experience of float boaters downstream. The water quality during regular and low flows has steadily improved over the past few years, but some mining practices still result in periods of degraded water in medium to low water flows.

The Cody Resource Management Plan/EIS (BLM 1988c; Bye-Jech 1998) addressed the effects of bentonite strip mining on recreation in northwest Wyoming. Before mining, the areas with potential for bentonite development offered limited recreation, including ORV use and some hunting. Bentonite mining has opened some areas that were previously inaccessible, decreasing opportunities for nonmotorized activities and increasing opportunities for motorized activities, including ORV use. These newly accessible areas have replaced hunting or ORV opportunities that were lost or reduced through mining.

Recreational Mining

Recreational mining includes a variety of activities such as gold panning, using backpack suction dredges and sluice boxes, rock collecting, and other nonmechanized activities. Recreational mining occurs to some degree in most of the western states but is difficult to define because it is based on the motivation of the participant rather than a specific activity. Recreational mining takes many different forms, including with a group or alone, with or without a mining claim or in BLM-designated areas, and as an occasional activity or a much more frequent one. Because BLM has considered much recreational mining casual use and no contact with BLM was required, the number of people engaging in recreational mining on public lands is not known.

Currently this activity is handled in different ways in BLM field offices. In some areas a recreation permit (not a 3809 authorization) is required to use an area that BLM has specifically developed for recreational use. An example is in northern California where people can rent a site for dredging and sluicing for up to 30 days. For this area BLM issues about 90 permits annually. In the Medford Field Office area (Oregon) four areas are open to dredging, panning, and sluicing, and BLM requires a free recreation permit is required.

In other areas mining clubs are active and own claims where their members can engage in mining for a fee. In the California Desert, mining clubs stake mining claims and stage mining events. These events might draw several hundred people, many of whom engage in dry wash placer mining. Mining club principals submit Plans of Operations. In these cases, each person might be engaging in casual use, but the cumulative effects of all the participants cause more than negligible surface disturbance.

In other cases no permits are required even though many people might use an area. At Topaz Mountain, Utah, people come from around the world to collect topaz using hand tools. No permit is required, and the number of collectors is not known.

Some tourists are also interested in visiting old mining camps or towns and seeing and participating in mining activities. Examples of such places include Nome, Alaska; Virginia City, Nevada; and Virginia City, Montana.

Environmental Consequences

Alternative 1: No Action

Under No Action mineral operations could continue to affect recreation user experiences as they have in the past. Examples of the types of impacts from current management are included in the discussion above. These effects would vary a great deal depending on the following:

- Resource setting.
- Current recreation use of the area.
- Size and type of mine.
- Opportunities for using alternative areas.

Overall, the mix of recreational opportunities could change in localized areas. Opportunities at the primitive end of the spectrum could decrease, while opportunities for more developed recreation could increase. Areas that offer experiences at the more primitive end of the recreation opportunity spectrum would be more vulnerable because mining tends to dominate local settings, potentially eliminating their wildland character. Recreationists who prefer a primitive setting could be faced with a choice of diminished experience, finding an alternative area in which to recreate, or giving up the activity. Mine development, however, could increase the opportunities for some types of recreation by building roads into previously inaccessible areas.

Effects to wildlife and streams would continue under this Alternative and could reduce hunting and fishing opportunities.

Opportunities for recreational mining would continue as they have in the past.

Alternative 2: State Management

Effects under the State Management Alternative could be similar to those under No Action. But the potential for mining-related effects to resources–including water quality, wildlife, and more primitive recreation settings–would slightly increase, generally due to the increased level of mineral activity.

Overall, the mix of recreational opportunities could change in localized areas. Opportunities at the primitive end of the spectrum could decrease, and opportunities for more developed recreation could increase. Areas that offer experiences at the more primitive end of the recreation opportunity spectrum (ROS) would be more vulnerable because mining tends to dominate local settings, potentially eliminating their wildland character.

Mine development, however, could increase the opportunities for some types of recreation by building roads into previously inaccessible areas. Effects to wildlife and streams would continue under Alternative 2 and could reduce hunting and fishing opportunities.

Opportunities for recreational mining could continue as they have in the past.

Alternative 3: Proposed Action

Effects under the Proposed Action would be similar to those for the No Action Alternative. Overall, the mix of recreational opportunities could change in localized areas. Opportunities at the primitive end of the spectrum could decrease, and opportunities for more developed recreation could increase. Areas that offer experiences at the more primitive end of the recreation opportunity spectrum would be more vulnerable to mining because mining tends to dominate local settings, potentially eliminating their wildland character. Mine development, however, could increase opportunities for some types of recreation by building roads into previously inaccessible areas. The magnitude of the above changes would be much less than under No Action.

The potential for mining-related effects to resources, including water quality, wildlife, and more primitive recreation settings, would be much less than under No Action. This reduction would help maintain existing recreation uses related to fishing and hunting. In addition, visual resources would be much better protected than under No Action.

Recreational mining that meets the casual use criteria (such as gold panning, metal detecting, rock collecting, hand and battery drywashers) would continue as before. A Notice or Plan, including bonding for reclamation, would be required if an activity were to exceed the casual use threshold. Suction dredging would be allowed without a Notice or Plan if a state permit is required and BLM and the state have signed an agreement. But none of these agreements are in place, and it is unclear how they would function because each would depend on local management decisions.

If BLM and the state do not have an agreement, the operator must contact BLM to see if the action exceeds casual use. In those cases the operator would have to file a Notice or Plan with bonding, and that process might delay or preclude some activity. Casual use mining would decline by an estimated 10% to 25%, with the decline in activity disproportionately falling on suction dredge users. Once participants become familiar with the new rules, however, the effect could decrease.

Alternative 4: Maximum Protection

Effects on recreation under Alternative 4 would be similar to those under No Action. Opportunities at the primitive end of the spectrum could decrease, while opportunities for more developed recreation could increase in localized areas. Areas that offer experiences at the more primitive end of the recreational opportunity spectrum would be more vulnerable to mining development because mining tends to dominate local settings, potentially eliminating their wildland character. Under Alternative 4, however, large open pit mines, which have the greatest potential to affect recreation, would decline more than any other type of activity. The magnitude of the changes in the mix of recreational opportunities would be much less than for No Action or the Proposed Action.

To the degree that mining would decline (up to 65% from the current situation, depending on the type of mining), Alternative 4 would allow more opportunities for recreation than would any of the other alternatives. But Alternative 4 would forgo recreation opportunities created by mine roads providing access into previously inaccessible areas.

Under Alternative 4 all participants in mining activities would have to contact BLM to determine if their planned activity is casual use or if a Notice or Plan (including bonding for reclamation) is required. Requiring all participants to consult with BLM and some to file Notices or Plans might delay or preclude some recreational mining. Casual use mining would decline by an estimated 30% to 50%. The decline in activity would disproportionately fall on suction dredge users. Once participants become familiar with the new rules, however, the effect could decrease.

Alternative 5: NRC Recommendations

Effects under Alternative 5 would be similar to those under No Action. Overall, the mix of recreational opportunities could change in localized areas. Opportunities at the primitive end of the opportunity spectrum could decrease. Opportunities for more developed recreation could increase. Areas that offer experiences at the more primitive end of the recreation opportunity spectrum would be more vulnerable to mining because mining tends to dominate local settings, potentially eliminating their wildland character. Mine development, however, could increase opportunities for some types of recreation by building roads into previously inaccessible areas. The magnitude of the above changes would be slightly less that under No Action.

The potential for mining-related effects to resources, including water quality, wildlife, and more primitive recreation settings, would be slightly less than under No Action. This reduction could help maintain existing recreation uses related to hunting and fishing.

The definition of causal use would remain the same under this Alternative 5, so recreational mining that meets the criteria for casual use would continue as before.

Visual Resources

Affected Environment

Public lands in the study area are renowned for their diverse scenic and visual resources. Generally good air quality and dramatic topography combine to create spectacular vistas. The popularity of scenic and backcountry byways and scenic overlooks illustrates the value and appreciation of scenic quality. Scenic values can also be tied to America's number one pastime of driving for pleasure.

BLM has a basic stewardship responsibility to identify and protect visual values on public lands. These public lands have a variety of visual values, and these values warrant different levels of management. Because it is neither desirable nor practical to provide the same level of management for all visual resources, BLM must systematically identify and evaluate these values.

This evaluation is based upon the apparent visual values of landscapes of similar character as shown on the map *Physical Divisions of the United States* by Nevil M. Fenneman and the U.S. Geological Survey (Fenneman 1946). Therefore, only landscapes of similar character are ranked against each other, thus eliminating the possibility of entire regions of the country being ranked as low-quality scenery when compared to other regions of high-scenic quality.

The visual values are identified through the visual resource management (VRM) inventory and are considered with other resources in the resource management planning (RMP) process. All BLM lands within resource management planning areas are assigned a visual resource management (VRM) class. Class I is assigned to all special areas where a management decision has been made to maintain a natural landscape. Class I areas include designated wilderness, wild sections of wild and scenic rivers, and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape (i.e. wilderness study areas).

Classes II, III, and IV are assigned by a process that considers scenic quality, viewer sensitivity to changes in the landscape, and distance zones (BLM 1986). Scenic quality, a measure of the visual appeal of a tract of land, is determined by using the seven key factors of landform, vegetation, water, color, adjacent scenery, scarcity (uniqueness), and cultural modifications. Sensitivity, a measure of public concern for changes to the scenic quality, considers the types of users, amount of use, public interest, and adjacent land uses.

Distance zones are based on the premise that the closer a point in the landscape is to the viewer, the more the details are visible and the greater the visual impact from a surface-disturbing activity. Distance zones examine relative visibility from travel routes or observation points and consider whether something is in the foreground-middleground, background, or seldom seen.

From the above information, BLM-managed areas covered by resource management plans (RMPs) are assigned a management class that represents the relative value of the visual resource and prescribes the level of acceptable change in the landscape. The VRM class objectives are described below.

Class I Objective - **No Visible Change:** The objective of this class is to preserve the existing character of the landscape. This class allows natural ecological changes but does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II Objective - **Change Visible but Does Not Attract Attention:** The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III Objective - **Change Attracts Attention but Is Not Dominant:** The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.

Class IV Objective - **Change Is Dominant but Mitigated:** The objective of this class is to allow management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. But every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

Information Bulletin No. 98-135 (BLM 1998b) recently articulated BLM policy toward visual resources. This policy does not represent a change from current policy but a renewed emphasis on the importance of the program. The information bulletin stated that BLM has a basic stewardship responsibility to manage visual resources on public lands. Local management discretion for decisions on VRM issues is guided by this basic stewardship responsibility and decisions in planning documents. It is BLM policy that visual design considerations be incorporated into all surface-disturbing projects on public lands, regardless of the size or potential visual impact of these projects. The VRM system should not be viewed as a means to preclude development, but rather as a design tool to help management minimize potential visual impacts (BLM 1998b).

BLM does not have information on the national distribution of its lands within the VRM classes. Conflict over scenic values are most likely to occur in areas of high mineral potential in mountains, river valleys, or other areas with high scenic values. The effects of mining on visual management objectives for an area depend on a variety of factors, including the size and type of mine, the basic visual elements of the landscape and the proposed project, and the ability to mitigate visual impacts. The following examples outline potential effects to scenic values under current conditions from two large open pit mines, a placer mine, and a bentonite strip mine.

Impacts to scenic values have the potential to be most severe when a large open pit mine is in an area of high scenic quality. An example of severe impacts to scenic quality can be seen at the mining development at Zortman, Montana, in the Little Rocky Mountains (BLM and Montana Dept. of Environmental Quality 1996).

The Little Rocky Mountains are an isolated area of domed mountains roughly 10 miles in diameter. The rounded crests rise nearly 3,000 feet above the surrounding plains. The topographic relief, colors, and textures of the mountains and their vegetation contrast with the relatively homogeneous terrain, lines, forms, colors and textures of the adjacent plains. In an assessment of the scenic quality of the Little Rocky Mountains, completed in 1979, the area was found to have Class A scenery and was given a Class II VRM rating (BLM and Montana Dept. of Environmental Quality 1996).

Since 1979, disturbance at the Zortman Mine has resulted from mine pits, heap leach pads, waste rock storage areas, roads, topsoil stockpiles, processing areas, and other ancillary facilities. Mining has greatly changed landforms, creating sharp contrasts with the lines, forms, colors, and textures visible in the natural landscape. The scale of the disturbance dominates the viewer's attention.

These contrasts are visible from many of the surrounding peaks and buttes. Recreationists use these peaks and buttes for hiking, picnicking, and wildlife viewing. American Indians use them for cultural purposes. The current disturbance at the Zortman Mine is incompatible with the objectives for VRM Class II landscapes. Topography changes have caused an irretrievable loss of the area's characteristic landscape.

The Bootstrap Project is an open pit mine in the Carlin Trend near Elko, Nevada (BLM 1996c; Treiman 1998). The landscape, which is characterized by broad open vistas framed by scattered hills and mountain ranges, has been given a Class IV designation.

The main impact of the mine is large-scale modification of landforms. Angular, blocky forms and horizontal lines have created moderate contrasts with the natural rounded, rolling hills and ridges of the characteristic landscape. Land clearing and construction of waste rock storage and leach facilities have exposed soil and rock in a variety of colors. The visual impacts of new structures are small when compared to the visually dominant waste rock disposal areas and mine pits.

Mitigation measures developed to reduce visual contrasts include locating facilities in less visible areas, minimizing disturbance, and repeating the basic elements of form, line, color, and texture. Following successful reclamation, the most noticeable residual effect of the proposed action would be the mine pits.

The Birch Creek Placer Mining Final Cumulative EIS (BLM 1988a; McClain 1998) discusses the potential visual effects from placer mining in the Birch Creek watershed about 70 miles northeast of Fairbanks, Alaska. Birch Creek, a national wild river, is managed as part of the Steese National Conservation Area. The landforms are defined mainly by the Birch Creek drainage. The characteristic landforms consist of lower, rounded mountains and hills with bedrock intrusions that have been shaped and dissected by flowing water. The major tributaries of Birch Creek flow through deep, narrow valleys.

The Birch Creek National Wild River has been rated as VRM Class I. But past and present activities–such as placer mining, road construction, and other similar activities that have altered the characteristic landscape–are incompatible with Class I objectives. Mining disturbance is reclaimed, but the surface is revegetated by natural processes. Meanwhile, the cumulative impacts continue to increase.

The Cody Resource Management Plan/EIS (BLM 1988c; Bye-Jech 1998) addresses the effects of bentonite strip mining on visual resources. Before mining, the areas with potential for bentonite development received VRM Class III or IV ratings. Visual quality has declined in specific areas due to bentonite mining but still meets VRM class objectives.

Environmental Consequences

Management Common to All Alternatives

All exploration and mining would operate under the BLM policy that visual design considerations be incorporated into all surface-disturbing projects on public lands, regardless of the size or potential visual impact of these projects (BLM 1998b).

Alternative 1: No Action

Effects to scenic values under No Action would be similar to those described above. Project- specific impacts would depend upon the size and type of the project, the area's topography, the ability to mitigate effects, and other factors. Some projects still might not meet VRM objectives, especially large open pit mines in areas designated Class I or II. Mining in Class I or II areas could contrast in texture, color, form, and line with the natural landscape. This mining could cause a permanent loss of scenic values and scenic integrity and could negatively affect activities such as tourism and recreation that depend, at least in part, on scenic values. Mining development in areas designated Class III or IV would be more likely to meet objectives because more modification of the landscape is allowed.

Alternative 2: State Management

Under State Management adverse effects to the visual environment could be greater than under No Action. Reclamation efforts would be similar, but less emphasis would be placed on scenic quality. Additionally, Alternative 2 would slightly increase mining, increasing the potential for disturbance to visual resources.

Alternative 3: Proposed Action

Under the Proposed Action project-specific impacts would depend upon the size and type of the project, the area's topography, the VRM goals, and the ability to mitigate effects. Overall, the effects to scenic quality would be much less than under No Action because of the revised definition of "unnecessary or undue degradation," stricter reclamation standards, and less mining overall. Unnecessary or undue degradation would include protecting cultural and environmental resources from harm that could not be effectively mitigated. These resources could include viewsheds of regional or national importance and viewsheds related to cultural areas. Mining development in all classes would be likely to meet objectives.

Alternative 4: Maximum Protection

Project-specific impacts would depend upon the size and type of the project, the area's topography, VRM goals, and the ability to mitigate effects. Overall, the effects to scenic quality would be much less than under No Action because of much stricter reclamation standards, including mandatory pit backfilling, better road design, and enhanced revegetation standards. Fewer operations would fall under casual use, and much less mining would occur, especially open pit mines, which tend to have the greatest effect on visual resources. Projects would be more likely to meet VRM objectives because of the lessened effects to the visual environment discussed above and the requirements for projects to conform to BLM land use plans.

Alternative 5: NRC Recommendations

Effects to scenic values would be similar to those under No Action. Project-specific impacts would depend upon the size and type of the project, the area's topography, the ability to mitigate effects, and other factors. Some projects still might not meet VRM objectives, especially large open pit mines in areas designated Class I or II.

Mining in Class I or II areas could contrast in texture, color, form, and line with the natural landscape. This mining could cause a permanent loss of scenic values and scenic integrity and could negatively affect activities such as tourism and recreation that depend, at least in part, on scenic values. Mining development in areas designated Class III or IV would be more likely to meet objectives because these classes allow more modification of the landscape. The magnitude of the effects would be slightly less than for No Action.

Cave Resources

Affected Environment

Caves can be found in any type of rock as a result of a variety of natural forces. Karst features, depressions, sinkholes, caves, or underground drainages are usually found in sedimentary rocks, notably limestone, dolomite, or gypsum. Caves in igneous rock include flow features such as tubes, lava blisters, and fissures created during eruptions. Overhang and cliff caves may be found in any type of rock. They are usually erosional remnants that can vary in depth and length from a few feet to several hundred feet.

Cave resources are defined in 43 CFR 37.4 as follows:

> *"...any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge, including any cave resource therein, and which is large enough to permit a person to enter, whether the entrance is excavated or naturally formed. Such terms shall include any natural pit, sinkhole, or other feature."*

This definition excludes abandoned mine tunnels or other human-made features.

The Federal Cave Resources Protection Act of 1988 (FCRPA) provides for the designation of significance based upon the following criteria: biota, cultural, geological/mineralogical/paleontological, hydrological, recreational, and educational or scientific values. Upon discovery, a cave is evaluated to determine its significance. If a cave is determined to be significant, its entire extent, including passages not mapped or discovered at the time of determination, is deemed significant.

To date, 510 caves on federal lands have been designated as significant, and 25 limestone caves have been withdrawn from mining claim location. At least 30 caves have been affected by mining operations of some kind. At least four of these were significantly affected to the extent that they no longer exist.

Where they exist, state laws protecting cave resources are usually limited to resources on state lands or parks or other resources administered by the state. Few states have laws that protect caves regardless of ownership.

Environmental Consequences

Impacts Common to All Alternatives

Impacts to cave resources are actions that would impair or destroy the caves or any of the characteristics that make them significant. These impacts could directly result from mining if a mine were on or next to a significant cave. Impacts, particularly to caves that contain cultural or paleontological material, are not as likely to occur under Plan-level activity as they are under Notice-level activity because Plans of

Operations require environmental review procedures that protect cave resources. In caves near mineral operations, fragile cave formations can be disturbed or dislodged by seismic activity. These impacts are often difficult to predict.

Studies on the effect of mining on cave resources are limited, but potential effects can be listed. Exploration, particularly drilling, has the potential to breach the fragile cave environment. Disrupting the air or water movement or temperature in a cave interferes with cave growth and development, speleothem growth, and the maintenance of a healthy ecosystem for cave wildlife.

Any microflora or fauna within the caves have evolved in response to the delicate balance between water and air. Any surface- or soil-disturbing activities that either increase or decrease the amount of air or water within a cave would harm the cave system. Changing the water quality or quantity by aquifer disruption or introducing water into an aquifer could also affect the cave environment. Increased soil erosion and siltation could prevent water infiltration into cave systems by normal routes and adversely alter speleothem growth. Additionally, excessive siltation and sediment loads in the underground streams and pools would have highly adverse impacts on the aquatic wildlife.

The desirability of disturbed caves for recreational use could decrease, and caves could present greater risks to entrants, depending on the degree to which air and water movements have been altered and the amount of blasting and other structural modifications created by mining.

Other impacts to caves might result from increased visitation and vandalism as a result of improved access to new mines being developed in previously remote areas. These indirect impacts could range a considerable distance from a new mine and include inadvertent or intentional damage from visitors or collectors as well as disturbance of bat colonies and other wildlife.

Alternative 1: No Action

Direct impacts are expected to continue to decrease under the No Action Alternative, mainly because of the ongoing implementation of the Cave Resources Protection Act of 1988, an increased awareness of cave resources, and mineral withdrawal of areas with significant caves. Exploration and Notice-level mining would likely continue to damage cave sites. Indirect impacts from existing and new mines would continue at the same rate or slightly less, depending on the number of new mines, the expansion of existing mines, and the success of withdrawals. These impacts would result from increased human activity in an area. As such they are not easily predictable.

Alternative 2: State Management

State laws protecting cave resources vary. Six western states have statutes that give some protection to cave resources but none to the same extent as the Federal Cave Resources Protection Act. In those states impacts to caves might increase slightly. In the western states without cave regulatory protection, cave resources are likely to experience an increase in adverse effects. States lacking an equivalent to the National Environmental Policy Act are not likely to consider wildlife, cultural, or paleontological values in caves. Impacts to caves containing these resources would increase. Indirect impacts to existing and new mines would continue.

Alternative 3: Proposed Action

Specific language directed at cave resources in the proposed regulations and the defining of unnecessary or undue degradation to include scientific values would increase the consideration of caves in the evaluation of both Notice- and Plan-level operations. This consideration might prevent both direct and indirect impacts. Specifically, impacts from Notice-level mining would likely be reduced because of new definition of unnecessary or undue degradation.

Alternative 4: Maximum Protection

Under Maximum Protection, all mineral activity that could cause disturbance exceeding casual use would require a Plan of Operations and would be subject to a thorough review by BLM. The elimination of Notices would reduce impacts to all cave resources. Also, greater emphasis upon land use planning documents would further protect caves.

Alternative 5: NRC Recommendations

Impacts to Cave resources under this Alternative would result from incidental use and exploration. All other activities would require a Plan of Operations which would provide for environmental review and greater protection of cave resources.

Paleontological Resources

Affected Environment

Paleontological resources are the remains of plants and animals preserved in soils and sedimentary rocks. They are important for understanding past environments, environmental change, and the evolution of life. Paleontological resources can be found in any sedimentary formation or soil deposition context. The highest potential exists in badlands shale, sandstone, limestone outcrops, adjacent fault scarps, and eroded lands.

The Federal Land Policy and Management Act directs agencies to manage paleontological resources to preserve them for scientific and public uses. Paleontological resources have not been systematically inventoried on most BLM-administered lands.

BLM has found 5 million acres of sensitive fossil-bearing geological deposits on western federal land. The fossils range in age from the Precambrian (more than 500 million years ago) to the recent (the last 10,000 years) and include examples of all extinct and living phyla. Paleontological remains include mammoths from the Ice Age, about 10,000 years ago, to the microorganisms that constitute the earliest evidence of life some 2.8 billion years ago. Paleontological remains discovered on federal land include dinosaur remains in Alaska, Nevada, Utah, Colorado, Wyoming, California, and Montana; fossil fish deposits in the Green River Formation of Wyoming; insect and plant fossils in Nevada, large petrified trees in Arizona and Nevada, and recent-age fossils in Alaskan deposits.

Mineral activities can benefit paleontological research when significant resources are discovered, reported, and recovered as a result of activities ranging from exploration to extraction. The removal of overburden during mining can expose fossil-bearing formations for inspection and possible discovery. But surface-disturbing activities can harm paleontological resources if deposits are not recognized or reported and significant fossil information is displaced or lost.

Since 1931 paleontological resources have been found in no more than 3% of Notice-level operations, mainly in Utah, Montana, and Wyoming. In Alaska the number is higher; 26% of Notice-level operations have found paleontological remains because of the higher proportion of placer mining there. BLM has issued no notices of noncompliance for damage to paleontological resources.

Paleontological resources have been found during Plan-level activity in most states. New Mexico, Oregon, Washington, Utah, Alaska, and Montana have had paleontological resources discovered from 6% to 10% of the time during mining. In the other states paleontological resources have been found in 1% or 2% of Plan-level operations. In Plan-level operations mitigation measures are used to reduce the impact and prevent the loss of information.

Environmental Consequences

Alternative 1: No Action

Impacts to paleontological resources from Notice-level activity would continue at the present rate of 26% of all Notices submitted in Alaska, to about 3% of all Notices submitted in the other states. Plan-level operations would continue to have both adverse and beneficial impacts at the present rate.

Alternative 2: State Management

Under Alternative 2, operators might not recognize or report paleontological resources. Few states have laws protecting paleontological resources, and most protection is restricted to state land. Depending on the state program, much paleontological resource and associated site information could be lost.

Alternative 3: Proposed Action

Increased protection or preservation of paleontological resources would result from requiring Plans of Operations for private surface overlying federal minerals. The Proposed Action would slightly reduce impacts to paleontological resources from both Notice- and Plan-level activities because sensitive lands would be included in the category of disturbances requiring Plans of Operations.

Language directed at paleontological resources in the proposed regulations and the defining of "unnecessary or undue degradation" to include scientific values, would increase BLM's consideration of paleontological resources in evaluating mineral activity. This consideration might prevent both direct and indirect impacts. Specifically, impacts from Notice-level mining would likely decline because of new definition of unnecessary or undue degradation.

Alternative 4: Maximum Protection

The Maximum Protection Alternative would reduce the potential for impacts to paleontological resources. Paleontological resources on private surface overlying federal minerals would also be inventoried and recovered. Paleontological information would no longer be lost from Notice-level activity because all mining and exploration would require Plans of Operations.

Increased time frames for Plan review would allow more extensive examination of proposed disturbance areas to determine either the existence of fossils or the potential for the area to produce significant fossils. The unlimited time period for evaluating and recovering fossils discovered during operations would allow for complete data recovery in areas containing complicated fossil deposits.

Alternative 5: NRC Recommendations

Most impacts to paleaontological resources occur from mining and all mining activities under Alternative 5 would now require a Plans of Operations which would lead to better protection paleontological resources then Alternative 1.

Cultural Resources

Affected Environment

Cultural resources are the fragile and nonrenewable remains of human activity. They are found in sites, districts, buildings, and artifacts that are important in past and present human events. Cultural resources are arbitrarily divided into historic and prehistoric cultural properties and traditional lifeway values, although they are part of a continuum of human use and occupation of the land.

A traditional lifeway value is important for maintaining a traditional system of religious belief, cultural practice, or social interaction for a contemporary ethnic or cultural group or community. Shared traditional lifeway values are abstract, nonmaterial, ascribed ideas that cannot be discovered except through discussions with members of the particular group. Lifeway values may or may not be closely related to narrowly defined locations.

Table 3-28. Designated Nationally Significan Cultural Resource Areas

Designation	Number	Estimated Acreage
National Historic Trails	8	1,271,880 (3,590 miles)
National Register Properties Listed	3,610 Contributing Properties * 255 Listings	NA
National Historic Landmarks	22	117,167
Areas of Critical Environmental Concern	123	1,428,980

* Buildings, sites, structures, or objects adding to the historic significance of a property.

As of 1999, about 5.7% of the BLM-administered lands had undergone cultural resource inventories. As a result, 227,993 sites have been recorded with 19,297 properties found to be eligible for listing on the National Register of Historic Places. In addition, certain areas have been designated at least in part because of their cultural resource content. Table 3-28 shows the numbers of nationally significant designated cultural resource areas.

Prehistoric Resources

Prehistoric properties in the United States extend back to the earliest human migrations to the Western Hemisphere, some 15,000 years ago. Prehistoric properties range from isolated artifacts, through small-scale habitation sites, to complex agricultural villages and densely populated pueblos. Prehistoric human occupations were rarely uniform over large areas, particularly where there were significant ecological changes over short distances. Consequently, site types, sizes, and densities are extremely variable. American Indians typically consider prehistoric resources to be ancestral sites.

Prehistoric cultural resources have been organized into early, middle, and late periods, with the early period commonly called Paleo-Indian (15,000 to 8,000 years ago), the middle period Archaic (8,000 to 2,000 years ago), and the final period Late Prehistoric (2,000 to 200 years ago).

Cultural resources from the Paleo-Indian period are found in high-elevation coniferous and deciduous forests and also lower elevation plains grasslands and in parts of the desert Southwest, mainly near water sources and in alluvial and colluvial soil deposits. People during this period often hunted megafauna, such as mammoth and giant bison, which are now extinct.

Prehistoric cultural resources from the Archaic period reflect a shift from an exploitation of megafauna to an emphasis on hunting and collecting a variety of resources, such as fish, large and small game, and edible plants and nuts. Hunting sites, plant gathering sites, and temporary camps are likely scattered in most western ecosystems.

Beginning about 2,000 years ago the Archaic period phased into the Late Prehistoric period with the introduction of agriculture, ceramics, the bow and arrow, and sedentary lifeways as major adaptive elements. In general, site types and patterns were the same as during Archaic times except where lifeways shifted to an agricultural base.

The Prehistoric era began blending into the Historic era in 1492, when Europeans started significant migrations to the Americas. The Historic era began in the Southwest and California in the 1500s with the Spanish entrada. In the Pacific Northwest and the Great Basin significant migration effects did not begin before the middle of the 1800s. In the Rocky Mountains and Plains the Historic era did not begin until the exploitation of the region by the fur trade in the late 1700s and early 1800s.

Historic Resources

Cultural properties of the Historic era continue to include indigenous materials, but the resources are now dominated by artifacts, sites, and landscapes of early Euro-American exploration, the fur trade, mining, logging, ranching, farming, transportation, manufacturing, and urban development.

Beginning about 1900 the Historic era blends into modern times although certain elements of traditional and historic cultures and lifeways are sometimes preserved. For example, American Indians continue traditional religious beliefs and practices and in many cases have maintained tribal uses of traditional plant gathering and hunting. Also, other native Americans retain values, sometimes as an occupation, in the land and its use and accessibility. These "Old West" attitudes are deeply held by the families who have owned land and lived for generations in the same area.

Traditional Cultural Resources

Traditional cultural properties and traditional lifeway values include areas for gathering plants, animals, or minerals that are important to American Indians and other cultural groups. They also include areas and landscapes that embody religious symbolism or are required for ritual practices. Rural historic landscapes that exemplify a historic lifeway, such as ranching or mining, may be important. Traditional cultural properties may also have historical significance from events such as battles or other local, regional, or national historic events.

Historic Impacts to Cultural Resources

There are three main sources of impacts to cultural resources. Vandalism to sites includes unauthorized collection, excavation, or defacing and is the most common source of loss of values. Impacts from vandalism increase as population increases and as access to an area improves. It is difficult to measure this type of impact. But where population increases, such as at mine openings, the amount of vandalism generally increases.

Loss of site information, material culture, or in situ information from unauthorized or inadvertent activity, such as an off-road vehicle use and sometimes casual use and Notice-level activity, is the second type of impact. Again, measuring this type of impact is difficult, and impacts sometimes go unnoticed for a long time.

Finally, previously unknown cultural resources, such as buried material with no surface indication, can be disturbed. Often a large portion of these types of resources can be destroyed before being noticed. If enough of this type of resource remains upon discovery by the operator, the recovery of the information would be a net benefit to cultural resources.

Before authorizing surface disturbance, BLM must determine what cultural resources are eligible for inclusion on the National Register of Historic Places and consider the effects of the proposed undertaking through the consultation process in Section 106 of the National Historic Preservation Act (NHPA) of 1966. This process is implemented according to 36 CFR 800. In many states, procedures for adapting the process to local needs have been developed through programmatic agreements among BLM, the state historic preservation officer, and the Advisory Council on Historic Preservation.

Section 106 of NHPA does not prohibit disturbing cultural resources. In fact, BLM may permit activities that result in adverse effects if mitigation cannot preserve all site information. Often this is the loss contextual information about the site, its existence within a particular ecological zone, or the inability to apply evolving techniques of data recovery. In addition, mitigation is required only if disturbance would affect a resource's attributes that make it eligible for the National Register. The one who would be mitigating the damage might ignore the attributes not considered significant to the site's eligibility.

In recent years, with an awareness and appreciation of cultural resources, properties and traditional lifeway values, the inventory, protection, stabilization, and enhancement of cultural resources have become an integral part of BLM procedures. While recovery of cultural resource information results in a loss of some in situ information, this loss of information is slight under most mitigation.

Casual use and Notice-level activity are not federal actions or undertakings and therefore do not require consultation under the National Historic Protection Act. But to meet the broad management responsibilities for cultural resources under the Federal Land Policy and Management Act, Archeological Resources Protection Act, National Environmental Policy Act, and National Historic Preservation Act, cultural resource specialists routinely review Notices. This involvement ranges from 50% to 100% of cases. In less than half of the cases, trained nonspecialists have been used to recognize resources for evaluation by specialists.

Notice-level actions disturb cultural resources, but nationwide only about 3%, on the average, of these actions either require mitigation or actually damage cultural resources. Of these 3%, only1% were listed on the National Register. BLM has issued eight notices of noncompliance since 1981 for damage to cultural resource sites. Only two of these sites were on the National Register.

The approval of Plan-level activities requires compliance with the National Historic Preservation Act. This process includes review by BLM cultural resource specialists. Generally, on-the-ground inventories are required for all potentially affected areas. Resources discovered during inventories are evaluated to determine their eligibility for inclusion on the National Register and how they would be affected by the Proposed Action.

Since 1981, up to 30% of the Plans of Operations submitted have involved prehistoric resources, and up to 50% have involved historic resources. The notable exception is in Alaska, where 92% of Plans of Operations submitted since 1981 have involved historic resources. BLM evaluated all of these sites according to existing regulations and found only 10% or fewer eligible for the National Register. Since 1981 BLM has issued only one notice of noncompliance for damage to cultural resources.

The benefit of mineral activity has been the addition of information to prehistory and history from the inventory and evaluation of sites in disturbance areas. The major contributions have been from processing Plans of Operations and, to a lesser extent, Notice reviews. If recognized in time, resources discovered during operations can contribute valuable information on cultural resources.

State laws protecting cultural resources vary. Burial laws are common to most states and are usually not specific to prehistoric or historic remains. These laws commonly require notifying the local coroner should a burial or human remains be discovered. State laws protecting prehistoric or historic sites are normally effective only on state-owned lands. In some cases these laws extend to private land where state or federal funds are involved.

Environmental Consequences

Recent Regulatory Changes Affecting Impacts under Alternatives 1, 3, 4, and 5

Since the completion of the draft EIS, changes in the 36 CFR 800 regulations now require consultation with tribal historic preservation officers. When Indian tribes and Native Hawaiian organizations attach religious and cultural significance to historic properties on and off tribal lands, consultation is required under section 101(d)(6)(B) of the National Historic Preservation Act. This consultation will reduce impacts to traditional cultural places and properties that have religious or cultural significance.

Alternative 1: No Action

Impacts to cultural resources would continue under Notice-level activity. The number of sites affected is expected to stay at the same level, about 3% of all cases. The recovery of site material during mine operations would benefit cultural resources.

Alternative 2: State Management

Mineral activity could increase by an estimated 5% under the State Management Alternative. State programs by themselves would generally not mitigate impacts to cultural resources or recover data from disturbed sites. Both the increased potential for disturbance and the lack of data recovery would significantly harm cultural resources.

Alternative 3: Proposed Action

For several reasons the Proposed Action would reduce impacts to prehistoric, historic, and traditional cultural resources for both Notice- and Plan-level activities. First, operators would submit fewer Notices and proportionally more Plans due to the expansion of special status areas. Overall, a more detailed cultural resource review would improve opportunities for recognizing and mitigating development and would better protect cultural resources.

Second, the amount of time allowed for recovering data from cultural resources discovered during operations would increase to 30 calendar days. This increased time would allow better or at least more complete recovery of data from cultural resource discoveries.

Third, the addition of split-estate lands with private surface ownership over federal minerals would occasionally allow data recovery and protection of cultural resources on these other lands.

Finally, the language used in the expanded definition of "undue or unnecessary degradation" standard to include "substantial irreparable harm to significant scientific, cultural, or environmental resource values of the public lands that cannot be effectively mitigated" implies that consultation through the National Historic Preservation Act (36 CFR 800.6(a)) will be completed where the standard is to be met. Therefore, both Notice- and Plan-level activities could involve consultation with state historic preservation officers and tribal historic preservation officers, reducing impacts to these resources.

Mineral activity under the Proposed Action is expected to decrease slightly from current levels. Although this decrease means fewer opportunities for cultural resource inventory and data collection from mining sites, it also means less potential to harm cultural resources. These two effects would be about equal. A decrease in mineral activity would benefit cultural resources on traditional cultural properties, national historic trails, or other areas where mining disrupts the setting of a historic property.

Alternative 4: Maximum Protection

For several reasons Alternative 4 would give the most protection to cultural resources of all alternatives. First, Notices would be eliminated. All previous Notice-level activity would have to be conducted under Plans of Operations, resulting in more detailed cultural resource reviews with improved opportunities for recognizing and mitigating development. Cultural resources would be better protected.

Second, the amount of time allowed for the recovery of data from cultural resources discovered during operations would increase from 10 working days to an unlimited time period. This time frame would give sites discovered during mining a sufficiently detailed recovery strategy commensurate with their significance, resulting in improved or at least more complete recovery of data from cultural resource discoveries.

Third, the addition of split-estate lands with privately owned surface over federal minerals, and lands with BLM-managed surfaces only would allow for data recovery and protection of cultural resources on other lands.

Also, the amount of mineral activity is expected to decrease from current levels. This decrease means a decrease in opportunities for cultural resource inventory and data collection for mineral projects. But this decrease also means less potential to harm cultural resources. Since all activity potentially affecting cultural resources could be controlled under Plans of Operations, the decrease in data collection opportunities from sites would outweigh any benefit of decreased mineral activity.

Alternative 5: NRC Recommendations

Alternative 5 would eliminate impacts from Notice-level mineral activities other than from exploration.

American Indian Resource Concerns

Affected Environment

American Indians sometimes use BLM-managed public lands for a variety of traditional purposes. They may use the lands to gather native plants, animals, and minerals for use in religious ceremonies, rites of passage, folk medicine, subsistence, crafts, and other traditions. Contemporary use areas often include traditional plant and mineral collection locales, vision quest sites, sun dance grounds, shrines, and traditional trails. Lands with a history of traditional use or having traditional lifeway values may be eligible for listing on the National Register of Historic Places as a traditional cultural property (TCP).

Because of their combination of geology with topography, lands used by American Indians for traditional cultural practices or having traditional cultural resources often contain valuable mineral deposits that are the focus of exploration and development. Conflicts over mineral activities in these areas are becoming increasingly common. Individual American Indians often view these lands as sacred and regard any disturbance or intrusion in these areas as desecration that cannot be mitigated.

Sometimes the use of the public lands is subject to treaties between the United States and a particular tribe. Treaty rights are often defined from the "canons of treaty construction":

- That ambiguities must be resolved in favor of the Indians.
- That treaties must be interpreted as the Indians would have understood them.
- That the treaties must be construed liberally in favor of Indians.

Since these treaties were signed between sovereign nations, the retained rights have a constitutional basis. These rights may include access to and use of "unoccupied federal land" in the conduct of daily lives, usually for subsistence activities. The exercise of treaty rights would supersede the requirements or procedures in the 3809 regulations and is outside the scope of the regulations.

Regulatory Statutes and Executive Order 13084

The American Indian Religious Freedom Act of 1978 (AIRFA) and Executive Order 13007 require federal agencies to evaluate their policies and procedures to protect the religious freedom of American Indians. AIRFA was passed as a joint resolution of Congress and has no implementing regulations. The intent of AIRFA is to preserve for the American Indian the inherent freedom to practice traditional religions, including access to religious sites, use and possession of sacred objects, and freedom to worship through traditional ceremonies.

In American Indian religious practice, any geographic area can contain places that are significant for sacred practices or purposes. Those sacred places may embody spiritual values of specific landforms, indigenous rock art, medicine wheels, rock cairns, effigy figures, spirit trails and gates, caves, springs or lakes, Indian graves, and contemporary use areas. AIRFA requires agencies to consult with American Indians on religious use of an area but does not give that use controlling authority over other uses.

The Native American Graves Protection and Repatriation Act protects American Indian burial sites and access to them, prohibiting the desecration and removal of these sacred sites and associated materials. These sites may not be generally known but may be found through formal inventory, archaeological studies, or inadvertent discoveries.

Congress and the U.S. Supreme Court have affirmed the trust responsibility between the tribes and the United States. This doctrine relates to reservation and nonreservation lands where federal or federally authorized activities may affect tribal resources or the quality of life on the reservation.

Executive Order 13084, signed May 14, 1998, requires "regular and meaningful consultation and collaboration with Indian tribal governments in the development of regulatory practices on Federal matters that significantly or uniquely affect their communities; to reduce the imposition of unfunded mandates upon Indian tribal governments; and to streamline the application process for and increase the availability of waivers to Indian tribal governments." Because tribal lands are not defined as "federal lands" in the existing or proposed regulations and because the purpose of the executive order is to reinforce tribal standards rather than impose unfunded mandates on the tribes, this executive order is not likely to affect the applying of the regulations

The Alaska National Interest Lands Conservation Act (ANILCA) protects Native Alaskan and rural population subsistence activity on public lands. This act provides that the agency consider the affect of its actions on subsistence efforts of these groups. This consideration is applied as agency permit activity on a site-specific basis.

Generally, the states have no regulatory statutes for consulting with federally recognized tribes. But states do consult with tribes as they would with the public or a local division of government.

Historic Impacts

Consultation with recognized tribes has been inconsistent in the past. Since the 1980s consultation has become an increasingly important part of authorizing activities and planning.

Although not federal actions, BLM has conducted a limited number of consultations on Notice-level activity with tribal governments. The highest level of consultation occurred in New Mexico with 20% of the Notices. There is no record of consultation in six of the 11 BLM western states in the study area (not including Alaska). Tribal governments have either commented on or objected to 5% of the Notices in Montana.

Where BLM has played a definitive role in authorizing activities under a Plan, its consultation with tribes has been more consistent. Since 1990 most BLM states have actively sought comment from tribal governments on Plans of Operations, with an average of 27% of the Plans being submitted for consultation and 4% being amended or changed in response to consultation.

In several cases surface disturbance under Notices or Plans has adversely affected or had the potential to affect localities important to American Indian traditional lifeway values or traditional cultural properties eligible for the National Register. Despite consultation, some

American Indians regard surface-disturbing activities in certain areas as desecration. Such disturbance cannot be mitigated to eliminate American Indian objections to the actions.

Few state regulatory programs have mandated consultation on any issues outside the designated reservation on either state or private land.

BLM has addressed subsistence activities, particularly as related to Alaska National Interest Lands Conservation Act (ANILCA), in several-site specific placer mining EISs from Alaska: Fortymile River (BLM 1988d), Birch Creek (BLM 1988a), Beaver Creek (BLM 1988b), and Minto Flats (BLM 1988e) EISs. These documents have discussed potential impacts to subsistence activities. In general, placer mining could affect subsistence uses and needs in the following ways:

- By reducing potable water quality of a stream used as a source of drinking water.
- By disturbing or destroying fisheries, animal populations, or habitats that support subsistence fishing, hunting, or trapping.
- By increasing harvest through creating more or better access routes into an area.
- By causing sedimentation of waterways, which impedes human access to subsistence resources.

Each of the EISs found that mining would pose no more significant restrictions to subsistence activities and that applying performance and reclamation standards, in some cases, would have a net beneficial effect to access and water quality.

Environmental Consequences

Recent Regulatory Changes Affecting Impacts under Alternatives 1, 3, 4, and 5

Since the completion of the draft EIS, changes in the 36 CFR 800 regulations now require consultation with tribal historic preservation officers. When Indian tribes and Native Hawaiian organizations attach religious and cultural significance to historic properties on and off tribal lands, consultation is required under section 101(d)(6)(B) of the National Historic Preservation Act. This consultation will reduce impacts to traditional cultural places, and properties that have religious or cultural significance by requiring mitigating measures to be examined with tribal historic preservation officers.

Alternative 1: No Action

Consultation with potentially affected parties would continue to improve as a result of recent executive orders and management guidance on BLM's responsibility to the tribes. Tribal governments would also continue to play a more assertive role in land use planning to protect areas of traditional cultural importance.

Despite complete consultation, mineral exploration and development could harm some areas of traditional cultural importance. Residual impacts can be expected to continue from Notice-level activity because of the nondiscretionary nature of activities under the Mining Law and the inability to mitigate impacts to American Indian values.

Potential adverse impacts to subsistence rights are expected to continue as in the past (see Historic Impacts from Mining section under the Affected Environment above) and would continue to be considered on a site-specific basis.

Alternative 2: State Management

Adverse impacts to American Indian traditional cultural practices and resources are likely to increase under State Management. The level of mineral activity would increase slightly, and the greater the level of activity, the greater the potential for impacts. More importantly, most states do not have a mandate for consultation. Nor do they have a trust responsibility to protect tribal rights. Opportunities would decline for tribes to consult with the permitting authority on mitigating measures that could reduce impacts to their traditional cultural values.

The State of Alaska is not bound by the provisions of the Alaska National Interest Lands Conservation Act (ANILCA) to address impacts to subsistence activities. Exploration or mining could result in more adverse impacts to subsistence activities without applying the provision of ANILCA.

Alternative 3: Proposed Action

Adverse impacts to American Indian traditional cultural practices and resources are likely to decrease under the Proposed Action. The level of mineral activity would slightly decrease because the lower the level of activity, the less the potential for impacts.

Impacts would also decline because of increased levels of consultation with American Indians. The increase in special status areas and added requirement for when BLM would require Plans of Operations would result in more complete reviews of proposed activity and provide for extended consultation with American Indians.

But even improved consultation and reduced levels of mineral activity would not eliminate adverse impacts to areas of traditional cultural importance. Some residual impacts would continue from Notice-level activity because of the nondiscretionary nature of activities under the Mining Law and the inability to mitigate certain impacts to American Indian values.

The language used in the proposed definition of "unnecessary or undue degradation" would prohibit standard to include "substantial irreparable harm to significant scientific, cultural, or environmental resource values of the public lands that cannot be effectively mitigated." This means that consultation through the National Historic Preservation Act (36CFR800.6(a)) would be used where the standard is to be met for Plan-level activities affecting historic properties. Effects from Notices would still be considered, and consultation might still occur, but such actions would be outside the National Historic Preservation Act process because Notices are not federal undertakings.

Under the proposed regulations processing both Notices and Plans would involve increased consultation and consideration of Native American resource concerns, thereby reducing impacts to these resources or perhaps preventing harm by denying operations where the resource is significant and mitigation would not be effective. Traditional cultural resources would significantly benefit.

Potential impacts to subsistence rights would continue as in the pest (see Historic Impacts from Mining section under Affected Environment above), and BLM would continue to consider these impacts on a site-specific basis.

Alternative 4: Maximum Protection

Adverse impacts to American Indian traditional cultural practices and resources would decrease substantially under the Maximum Protection Alternative. The level of mineral activity would decrease moderately, and the lower the level of activity, the less the potential for impacts. Adverse impacts would also decrease because of increased levels of consultation with American Indians.

The elimination of Notices would make all activity above casual use subject to the review and consultation requirements of Plans of Operations. This change would result in more complete reviews of proposed activity and provide for extended consultation with American Indians to mitigate impacts.

In addition, BLM would require concurrence by potentially affected American Indians before approving surface disturbance on lands with traditional cultural importance, or lands used for traditional cultural practices. This requirement would greatly reduce or prevent adverse impacts to American Indian traditional cultural practices and resources.

The inclusion of split-estate lands under the 3809 regulations would give American Indians more opportunity to consult and mitigate impacts where, in the past, surface ownership has prevented such consultation or rendered it moot.

Potential adverse impacts to subsistence rights would continue as in the past (see Historic Impacts from Mining section under Affected Environment above), and BLM would continue to consider these impacts on a site-specific basis.

Alternative 5: NRC Recommendations

Alternative 5 would eliminate impacts from Notice-level activities other than exploration. A decline in impacts would continue as a result of more complete consultations.

Social Conditions

Affected Environment

Demographic and Social Trends in the West

In 1999, the population of the 12 western states in the EIS study area was 60 million. While these 12 states contain nearly half of the area of the United States, they are home to only 22% of the Nation's population. California has the largest population with more than 33 million residents. Alaska, Montana, and Wyoming each have fewer than a million people. Population densities vary from fewer than 5 people per square mile in Wyoming to more than 200 people per square mile in California. Though the area's population grew by 16% between 1990 and 1999, individual states varied. Nevada and Arizona grew the fastest, increasing by 51% and 30% respectively. Wyoming, Montana, and California grew the slowest at 6%, 11%, and 11% respectively.

In the rural West, population and social trends tend to respond to unique issues. Many areas are experiencing a significant increase in population after decades of stability or decline. Other rural areas continue to lose population due in part to the outmigration of young people who leave for advanced education, military service, and employment. Still other rural areas are subject to the population and employment boom-and-bust cycles of mining and other resource development.

The movement of people and jobs into some rural areas began in the 1970s and is expected to continue into the 21st century. The migration turn-around reflects a reversal of the rural-to- urban migration pattern found in most of the United States before the 1970s. Intermountain valleys, the settings for such places as Salmon, Idaho, and Missoula, Montana, typically experience inmigration. In scenic areas, particularly those suitable for recreation, ranches are being sold for recreation uses or subdivided for homes. Some immigrants buy small lots to ranch or farm but do not depend on an economic return from the property. These rural areas are moving from a long-term economic dependency on agriculture, logging, or mining to a dependency on recreation and tourism. This population inmigration has increased contacts between long-time rural residents and newcomers whose beliefs and values may challenge the existing way of life. Long-timers may feel they have lost control of their community, making it a less desirable place for them to live.

Other rural areas have continued to lose residents in the last decade. These communities typically have had economies based on agriculture, logging, oil and gas, or other mineral development and have suffered declines in population as agriculture mechanized and mineral development efforts came and went (boomed and busted). Some of these communities have difficulty maintaining their local businesses as well as such services as schools and health care. Residents are concerned about the economic survival of their communities and preserving their traditional lifestyles. While these communities can be located in many regions of the study area, many of them are on the western edge of the Great Plains in central and eastern Montana and Wyoming.

Major cities in the West–Denver, Seattle, Phoenix, Salt Lake City, San Francisco, and Los Angeles–have experienced significant growth over the last few decades. These urban centers are often the areas where environmental attitudes are most pronounced and many environmental groups have headquarters.

National and Regional Attitudes

Discussions about changes in the 3809 mining regulations are just one aspect of a broader debate on environmental issues and resource management that is occurring both in American society and globally. According to the report of the Forest Ecosystem Management Assessment Team (FEMAT) (1993), "This growing concern with the environment, from the international to local levels, appears linked to some fundamental structural changes taking place in industrialized societies. Shifts in education levels, population distribution, and composition and make-up of the labor force all combine to bring increased concern with issues related to the quality of life and other types of personal attitudes, including natural resources and the environment."

According to Stankey and Clark (1991), social values for lands and natural resources take many forms:

- Commodity values: timber, range forage, minerals.
- Amenity values: lifestyle, scenery, wildlife, nature.
- Environmental quality values: air, water quality.
- Ecological values: habitat conservation, sustainability, threatened and endangered species, biodiversity.
- Public use values: subsistence, recreation, tourism.
- Spiritual values: sacred places, wilderness areas.
- Health: medicines.
- Security: sense of social continuity and heritage.

In the past, natural resource management has tended to emphasize commodity values. The emerging emphasis on other values has forced a reevaluation of the commodity emphasis. Stankey and Clark's (1991) report states, "A new focus on the part of the public involved a shift from commodities and services to environments and habitats." More profoundly, these changing value orientations within society have led to changing expectations concerning the management of public lands.

A nationwide survey conducted by Roper Starch Worldwide (1997) offers some interesting information on attitudes toward environmental issues and regulations. When asked what was the leading environmental issue we face today, pollution was named by 60%, with 41% of respondents specifying air pollution and 29% specifying water pollution. Of the survey respondents, 65% said that environmental protection and economic development can go hand in hand. But nearly 70% said that when a compromise cannot be reached, they would choose the environment, while 15% would choose economic development.

Respondents to this survey were also asked whether they thought environmental laws and regulations had gone too far, had not gone far enough, or had achieved the right balance. Almost three times as many respondents thought laws and regulations had not gone far enough (46%) as those who thought laws and regulations had gone too far (17%). Just over a quarter of the respondents (27%) thought the laws had struck the right balance; 29% of respondents living in rural areas and 27% of respondents living in the West stated that environmental regulation had gone too far.

The following percentages of respondents stated that laws and regulations had not gone far enough in confronting the following environment issues:

- 72%, preventing water pollution.
- 62%, preventing air pollution.
- 48%, protecting wild or natural areas.
- 44%, protecting wetlands.
- 41%, protecting endangered plants and animals.

A counter-movement has been growing in the West. Where land use has been relatively unrestricted, there is increasing concern about the management and regulation of public lands. People with these concerns feel that change in public land management is being driven by government officials and environmental advocacy groups who do not have a true understanding of the lands or nearby residents who depend upon these lands for their livelihood and recreation. There is particular concern about the loss of traditional land uses such as livestock grazing, mining, and off-road vehicle use. People with these concerns seek to balance what they consider to be environmental extremism with economic and human concerns.

In scoping and other comment letters, some writers said that the freedom to engage in mining is part of the American heritage. They feel the romance and lure of prospecting and treasure hunting have been key components of our culture and history. As one commenter stated,

We in the West are proud of our mining heritage. In past generations, miners walked into unknown, hostile country to search for minerals to advance the new industrial age, without which we would not have the standard of living we do today. They were [illegible] ultimate pioneers because they came alone, not in wagon trains with many others to provide personal safety. They helped settle the West as much as farmers, ranchers and merchants, and, without their discoveries, the railroad would not have been encouraged to extend westward. This country would not have grown and become the great power it is today with minerals discovered by these mining pioneers.

Miners

This section will focus on small "mom and pop" type operations (up to three or four people) that function without outside financial backing. These operations may engage in exploration or small placer, open pit, or underground mines although they are most likely to engage in exploration or placer mining. Most of this activity operates as casual use or under Notices because these operations disturb less than 5 acres. The number of these miners is declining overall, although some new people are entering the field. In some cases several generations of a family work a claim. Some have family members employed outside the mine for more financial support. Many of these miners live an independent, solitary, self-sufficient lifestyle, especially in Alaska. These miners may also be mechanics, pilots, loggers, and skilled in construction; a variety of skills helps them maintain their independent lifestyle.

Some operations offer large financial rewards; others are marginal. Some miners from Alaska spend the summers mining and the winters in the lower 48 states. In the other 11 states in the study area some people spend their summers in northern states such as Idaho and their winters in places like Arizona working their claims. Little is known about these miners from a sociological standpoint. They do, however, appear to identify highly with their occupation and the lifestyle of that occupation and would resent being forced to change either.

Communities

The effects of mining on a rural community can be divided into four phases: exploration, development, production, and phase down or closure (Wenner 1992).

During exploration, the major effects would be increased business volume for motels, restaurants, and gas stations, plus some temporary employment for local residents. During this phase, local residents and special interest groups may become aware of potential nearby mineral development. The intensity of their reaction varies from one project to another depending on factors such as local economic conditions, existing land uses, local lifestyles, outdoor recreation preferences, the ecological sensitivity of the development site, and the way in which the proposed activity is designed and presented to the public. In general, local facilities and services do not need to significantly expand for exploration.

Site development is often the most labor-intensive phase of operations and can cause more social impacts than exploration and production because the workforce is larger. During this phase, employment opportunities for local residences and local expenditures might benefit some local residents. Rural counties and communities can be seriously overburdened if the firms involved fail to provide the housing and services their new employees require. The negative consequences of rapid development, such as increased crime rates and increased need for mental health services, are most evident under such conditions.

The production phase is ordinarily the most stable and enduring phase of a mineral operation. A major mine may operate continuously for two or three generations. Its presence in a relatively rural area is imposing and influences the social organization, outlook, and lifestyles of nearby communities.

The rate of population change is the single most important factor affecting community well- being, contributing to prosperity and infrastructure improvements in some instances and to economic instability, social disorganization, and adverse social conditions in others. As time goes on, community facilities expand to meet the needs of the newcomers, and they become integrated into the community.

A phase down or closure of a large mine can be a traumatic experience, especially for small communities in sparsely populated areas. The loss of well-paid jobs and the resulting outmigration can affect real estate values, the volume of local business activity, school enrollments, organizational membership, and the economic security and outlook of most of the resident population.

Communities come in a variety of forms and sizes, resulting in differing abilities to adapt to change. One study for the Interior Columbia Basin Ecosystem Project (Harris and others 1995) categorized communities by a variety of factors and determined the qualities that make a community "resilient" or able to manage change. According to the study, the qualities that allow communities to manage change include the following:

- Strong civic leadership.
- Strong economic structure.
- High degree of physical amenities.
- Positive, proactive attitude toward change.
- Large population.

Residents of small communities that rely on mining have voiced many concerns during this process. These concerns include effects to employment, families, lifestyles, and communities. Some said that the loss of high-paying jobs is particularly difficult where high-paying jobs are hard to find, and that mining employment, even if it doesn't last forever, can enable someone in the family to go back to school, or allow a family to purchase a home. Others said that some farms and ranch operations get through hard times when someone in the family finds a job in the mining industry.

Some also discussed the dependency of rural communities on tax monies and skills provided by the mining industry. Some stated that mining can give a small community technical expertise that a community of that size would not normally have, and that mining companies are good neighbors.

Environmental Advocacy Groups

During the scoping period, BLM received many letters from environmental advocacy groups stating their support for changes in the surface management regulations. Comments from the different groups were similar, and some groups submitted joint comments. These groups believe that active and abandoned mines continue to inflict substantial environmental damage on public lands in the study area and that strengthening the regulations could result in real environmental gains. Specific ideas included the following:

- Strengthening reclamation standards.
- Conducting unannounced inspections.
- Including third-party monitoring with more inspections of high-risk mines such as cyanide heap leach operations.
- Requiring Notice-level operations to operate under the same regulations as larger mines.

Some groups said that BLM should be able to deny mining where it is not a suitable use of public lands, such as areas with important water, wildlife, scenic, or recreation resources. According to these groups, BLM should also deny mining where a mining company cannot demonstrate that a mine site can be reclaimed. Some groups also said that they will continue to work for comprehensive reform of the 1872 Mining Law.

Environmental Consequences

Alternative 1: No Action

Effects to miners of small operations and to communities would continue as they have in the past because mining regulations would not change. Miners on small operations would support this alternative because changes in regulations would not affect their current occupation or lifestyle.

Increasing numbers of people in the West and across the country believe that the surface management regulations should increase emphasis on protecting amenity resources. (See discussion under National Attitudes at the beginning of the Social Conditions section.) Alternative 1 is not consistent with these attitudes.

The environmental advocacy groups and many of the people associated with these groups would not support current management because they believe it does not sufficiently protect the resources on public lands. The condition of the resources on public lands is important to these people because they value these resources for recreation, wildlife, scenic and spiritual qualities, and a variety of other reasons. Many appreciate just knowing that these areas exist and would continue to exist in the future.

Alternative 2: State Management

Generally effects to miners of small operations and to communities would continue as they have in the past because mining under state regulation would be similar to current management. Miners on small operations would support this alternative because changes in regulations would not affect their current occupation or lifestyle. Mining-dependent communities may develop benefits based on the slight increase in overall mining.

Increasing numbers of people in the West and across the country believe that the surface management regulations should increase emphasis on protecting amenity resources. (See discussion under National Attitudes at the beginning of this section.) Alternative 2 is not consistent with these attitudes.

The environmental advocacy groups and many of the people associated with these groups would not support Alternative 2 because it would result in no federal regulation of locatable minerals mining on public lands. In the opinion of these groups, this alternative would result in insufficient protection of resources on public lands. In addition, BLM would be seen as abdicating its management responsibility. The condition of the resources on public lands is important to these people because they value these resources for recreation, wildlife, scenic and spiritual qualities, and a variety of other reasons. Many appreciate just knowing that these areas exist and would continue to exist in the future.

Alternative 3: Proposed Action

Under the Proposed Action activity by small operations (i.e. exploration, placer mining, and open pit mining) is estimated to decline by 10% to 30% because more operations would have to submit Notices or Plans of Operations and meet other requirements such as bonding. But the level of change that would actually occur is highly uncertain. Miners who could not continue in the mining business might find the search for satisfactory alternative employment to be difficult.

The stress of needing to change professions and possibly lifestyles has repeatedly surfaced as an important social problem. All people, through the socialization process, form a mental picture of "who they are." Groups of people such as loggers, ranchers, miners, and farmers tend to strongly identify themselves as belonging and being in a certain life role. It is extremely hard for them to imagine themselves "being" anything else (Lee and others 1991). This is especially true if the person has been engaged in a business and lifestyle for many years.

The effects to these miners might be mitigated by the fact that many rely on an array of skills and abilities, not just mining, to support themselves. Also, in the long run, the effects might lessen as miners become knowledgeable about the new regulations. Miners on small operations would oppose these changes because of concern about impacts to their occupation and lifestyle.

Under the Proposed Action the declines in mineral activity for large exploration, placer, and open pit mines could decline by 10% to 30%. The level of change that would actually occur is highly uncertain. All or some of the decrease would be due to forgone future mining rather than current operations shutting down.

In small isolated communities with a high degree of specialization in mining, the impact of a mine shutting down would be significant. The loss of well-paid jobs would result in outmigration, which would lower real estate values, the volume of local business activity, school enrollments, organizational membership, and community leadership. The tax burden might be increased or the level of services reduced for those who remain in the community.

These changes could occur at a time of increased demand for social services due to employment losses. The economic security and outlook of most of the resident population, as well as their level of social well-being would be adversely affected (Wenner 1992). Nevada communities would have the greatest potential for significant impact because of the potential effects to large open pit operations and their concentration in Nevada. Larger communities with a lesser degree of specialization in mining are less likely to be affected.

Increasing numbers of people in the West and across the country believe that the surface management regulations should have an increased emphasis on protecting amenity resources. (See discussion under National Attitudes at the beginning of this section.) Alternative 3 is consistent with these attitudes.

Under the Proposed Action the environmental advocacy groups who participated in scoping and many of the people associated with these groups would support this alternative because they would feel that wildlife and water resources are being more adequately protected. Some environmental advocacy groups, however, would feel that the problems they perceive with locatable mineral mining on public lands are going to be addressed only with the revision of the 1872 Mining Law. The condition of the resources on public lands is important to these people because they value these resources for recreation, wildlife, scenic and spiritual qualities, and a variety of other reasons. Many appreciate just knowing that these areas exist and would continue to exist in the future.

Alternative 4: Maximum Protection

Under the Maximum Protection Alternative mineral activity for small operations (i.e. exploration, placer, and open pit mines) would decline by 20% to 50%. Large operations would decline by an estimated 20% to 75%. All operations would have to submit Plans of Operations and meet bonding and reclamation requirements. The effects to persons and communities would be similar to those described for the Proposed Action, but much more severe.

Increasing numbers of people in the West and across the country believe that mining management should emphasize protecting amenity resources. (See discussion under National Attitudes at the beginning of this section.) Alternative 4 is consistent with these attitudes.

The environmental advocacy groups and many of the people associated with these groups would support Alternative 4 because they would feel wildlife and water resources are being more adequately protected. Some environmental advocacy groups, however, would feel that the problems they perceive with locatable minerals mining on public lands are going to be addressed only with the revision of the 1872 Mining Law. The condition of the resources on public lands is important to these people because they value these resources for recreation, wildlife, scenic and spiritual qualities, and a variety of other reasons. Many appreciate just knowing that these areas exist and would continue to exist in the future.

Alternative 5: NRC Recommendations

Activity by small operations (i.e. exploration, placer mining, and open pit mining) is estimated to decline by 0% to 10% under Alternative 5. For small miners who must find alternative employment, the effects would be the same as those described for Alternative 3. The effect is expected to be small and might lessen in the long term as miners become knowledgeable about the regulation changes. Miners on small operations may oppose these changes because of concern about impacts to their occupation and lifestyle.

Activity by large operations (i.e. exploration, placer mining, and open pit mining) is estimated to decline by 0% to 5%. Small rural communities are expected to lose only a few jobs relative to overall employment. All or some of this decrease might be due to forgone future mining rather than current operations shutting down. Little social impact to communities is expected under Alternative 5.

An increasing number of people in the West and across the country believe that the surface management regulations should have an increased emphasis on protecting amenity resources. (See discussion under National Attitudes at the beginning of the Social Conditions sections.) Alternative 5 is consistent with these attitudes, but some people may feel that it does not go far enough to protect the environment.

Under Alternative 5, the environmental advocacy groups who participated in scoping and many of the people associated with these groups would feel that wildlife and water resources are not being protected well enough. The condition of the resources on public lands is important to these people because they value these resources for recreation, wildlife, scenic, and spiritual qualities, and a variety of other reasons. Many appreciate just knowing that these areas exist and would continue to exist in the future.

Economic Conditions

Affected Environment

This analysis describes trends generally dating back to 1980 to include the entire period that surface mining regulations have been in effect, and also to include trends that are expected to affect the industry into the foreseeable future.

Mineral Production

Contribution of Western States to Domestic Mine Production. In 1998 mine production of nonfuel minerals in the United States totaled $39.6 billion. Currently the 12 western states in the study area contain 49% of the total land area in the United States (including all land ownership types) and contribute 40% of all nonfuel mineral production nationwide, $16 billion as of 1998. The portion of total domestic production originating from the western states has ranged from 38% in 1980 to 43% in 1990 (see Table 3-29).

Since 1990 the top three states in the United States in the value of mine production have been western states: Nevada, California, and Arizona. These three states alone, with 11% of the total U.S. land base, contribute 23% of the total value of domestic mine production of nonfuel minerals. Further, these three states possess 22% of the land base in the study area but contribute 57% of area's total value of mine production (see Table 3-29).

A closer look at production by commodity reveals that the western states contributed more than 96% of all domestic precious metals production (e.g. gold and silver), 99% of all copper mine production, and 47% of other base metals and locatable-type industrials combined. Overall, the study area contributed an estimated

69% of the Nation's total locatable-type nonfuel mineral production in 1998, or $11 billion. ("Locatable-type" minerals are the types of minerals that if found on public land would be considered locatable.) As these numbers show, the western states produce a disproportionate share of domestic mine production of locatable-type minerals. (See Table 3-30 and Figure 3-3.)

Not all of this production comes from BLM-administered public lands. It is difficult to determine the portion of total mine production of all locatable-type minerals originating from BLM-administered land for two reasons: mines are not required to report these figures, and many mining operations are on lands in mixed ownership (some combination of federal, state, or private lands).

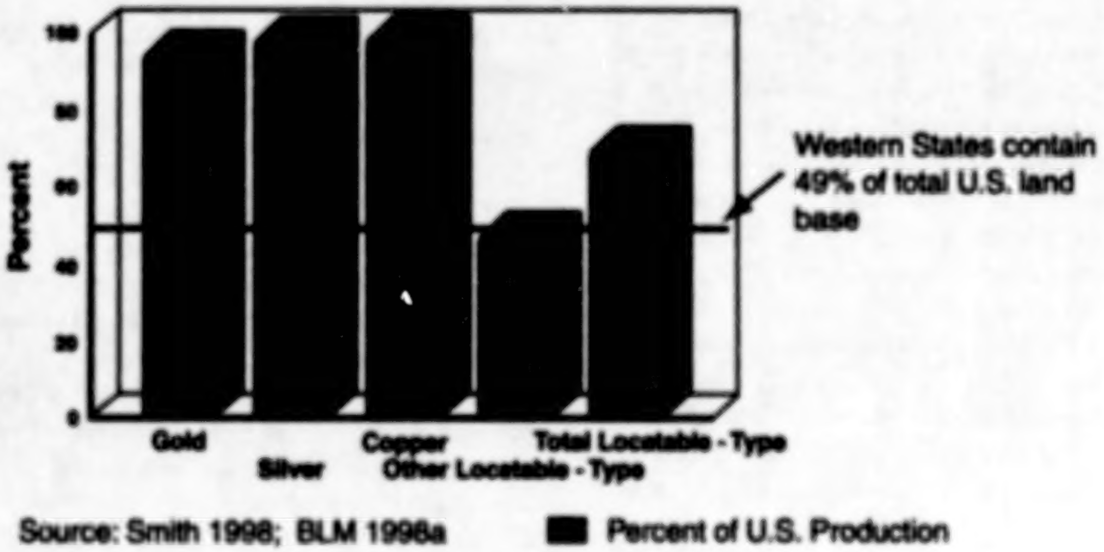
Nevertheless, two recent reports estimate federal land production. These reports show that by commodity the portion mined from federal lands is highly variable (USDI 1993; GAO 1992). About 43% of gold mine production in the western states is estimated to come from federal lands, 1% of copper production, and 2% of industrial minerals overall.

Table 3-31 shows the portion of locatable-type minerals produced from federal lands based on these percentages. In total, about 10%, or $1.7 billion, of all locatable-type minerals combined are estimated to originate from federal lands. Most of this value is due to gold production, of which $1.4 billion is estimated to come from federal lands.

Two factors may cause either an overestimate or underestimate of the value of mine production from BLM lands. First, these estimates include all federal ownership, not merely BLM- administered lands, which would overstate the value of mine production. Second, these estimates do not include mining facilities other than the mine itself and would tend to understate the value of production originating from BLM lands.

Figure 3-3

Western States Contribution to U.S. Mine Production of Locatable-Type Minerals in Relation to Land Base - 1998



Source: Smith 1998; BLM 1998a

Table 3-29. Value of Nonfuel Mineral Production 1980-1998 ($000)[1]

State	1980	1990	1998	Statewide Acreage[2]
Alaska	$113,000	$577,000	$999,000	$365,482,000
Arizona	2,430,000	3,065,000	2,770,000	72,688,000
California	1890,000	2,780,000	2,980,000	100,207,000
Colorado	1,260,000	386,000	650,000	66,486,000
Idaho	522,000	400,000	453,000	52,933,000
Montana	280,000	568,000	502,000	93,271,000
Nevada	386,000	2,611,000	3,170,000	70,264,000
New Mexico	785,000	1,098,000	888,000	77,768,000
Oregon	150,000	237,000	301,000	61,599,000
Utah	759,000	1,334,0Ό0	1,320,000	52,697,000
Washington	207,000	473,000	609,000	42,694,000
Wyoming	781,000	911,000	1,070,000	62,343,00ပ
Study-Area Total	9,520,000	14,440,000	15,712,000	1,118,429,000
U.S. Total	$25,108,000	$33,319,000	$39,600,000	$2,271,343,000
Study Area as Percent of U.S.	38%	43%	40%	49%

[1] Includes all nonfuel minerals, not all of which are "locatable-type" (such as sand and gravel, and other construction-type industrial minerals). Dollar figures rounded to three significant digits.

[2] Figures represent total statewide land area for all ownership types (federal and nonfederal).

Sources: Smith 1998; USBM 1982, 1992; BLM 2000a.

Table 3-30. Estimated Value of "Locatable-type" Nonfuel Mineral Production,[1] Total Value of Nonfuel Mineral Production and Ranking of Western States - 1998 ($000)

State	Gold	Silver	Copper	Other Metals and Industrials[2]	Total Value of Mine Production (Locatable-type Minerals)	Total Value of Mine Production (All Nonfuel Minerals)[3]
Alaska	$61,000	$21,800	N/A[4]	$478,000	$561,000	$613,000
Arizona	21,800	31,500	2,980,000	304,000	3,340,000	3,580,000
California	299,000	3,620	0	959,000	1,280,000	2,830,000
Colorado	60,000	1,250	0	251,000	312,000	513,000
Idaho	92,800	38,400	N/A	243,000	374,000	449,000
Montana	114,000	15,700	94,000	223,000	447,000	491,000
Nevada	2,680,000	101,000	58,000	233,000	3,070,000	3,230,000
New Mexico	5,010	3,330	615,000	76,200	700,000	992,000
Oregon	0	0	0	76,200	76,200	265,000
Utah	290,000	27,700	708,000	530,000	1,560,000	1,730,000
Washington	48,600	0	0	163,000	212,000	535,000
Wyoming	0	0	0	202,000	202,000	1,080,000
Study-Area Total	3,670,000	244,000	4,500,000	3,740,000	12,100,000	16,300,000
U.S. Total	$3,980,000	263,000	$4,610,000	$8,800,000	$17,700,00	$38,700,000
Study Area as Percent of U.S. Total	96%	98%	99%	47%	69%	40%

[1] Includes gold, silver, copper, and other metals (platinum group, lead zinc, molybdenum, etc.). Also includes large variety of industrial minerals such as barite, bentonite, diatomite, gemstones, gypsum, limestone, perlite, pumice, silica stone, talc, vermiculite, etc. [2] Other Base Metals and Industrials exclude common clay, phosphate, potash, salt, sand, gravel, sodium, stone, and sulfur because these minerals are not "locatable" when found on public land. [3] For some states, figures for specific minerals reported by USGS were withheld to avoid disclosure of confidential data and appear in totals with other minerals. Consequently, for some minerals (e.g. copper), state production values were estimated from state reports and other sources. Some other withheld mineral values are contained in "Total Value of Mine Production." [4] N/A means not available or not applicable.

Source: Smith 1998; USGS various years (b).

Table 3-31. Value of Locatable Mineral Production Originating from Federal Lands - 1998 (2000)

Portion of study-area production originating from public lands¹	43.4%	36.2%	1.0%	2.4%	N/A
State	**Gold**	**Silver**	**Copper**	**Other Metals and Industrials**	**Total**
Alaska	$75,500	$26,600	$0	$16,100	$118,000
Arizona	7,550	12,600	20,600	9,140	49,900
California	76,800	673	0	19,600	97,100
Colorado	31,700	825	0	7,480	40,000
Idaho	23,000	28,500	0	5,830	58,300
Montana	33,800	4,580	820	6,7100	45,900
Nevada	1,120,000	39,800	1,170	4,920	1,170,000
New Mexico	11,700	1,200	4,380	8,290	25,600
Oregon	0	0	0	2,010	2,010
Utah	47,700	6,910	4,880	10,800	70,300
Washington	14,600	37	0	3,730	18,300
Wyoming	0	0	0	5,240	5,240
Study-Area Total	1,440,000	120,000	31,900	99,800	1,700,000
U.S. Total (all land types)	$3,480,000	$339,000	$3,220,000	$8,920,000	$16,000,000
Federal Land Portion as Percent of U.S. Total	42%	35%	1%	1%	11%

¹Source: USDI 1993.
N/A = not applicable. Figures rounded to three significant digits. Some totals may reflect rounding errors.
Note: Includes all production from federal lands, not just production from BLM-administered lands.

Although mine production figures for some base metals such as zinc, lead, and molybdenum were generally unavailable by state for confidentiality reasons, several western states are major producers of these minerals. The western states are also major producers of many locatable- type industrial minerals. Table 3-32 shows the national ranking of the western states for many locatable-type minerals. It shows, for example, Alaska first in domestic mine production of zinc, Arizona first in copper and molybdenum, Montana first in platinum group metals and talc, Nevada first in gold and silver, and Wyoming first in bentonite.

Appendix G contains maps of the United States showing the importance of the western states to metal mine production (see Figures G-1 through G-4). These maps also show that for nonmetallic minerals (industrial minerals) mine production across the United States is more evenly distributed than for metallic minerals.

Trends in Mineral Production and Exploration

This section describes trends since 1980 and projections for future activity for the three main commodity groupings: precious metals, base metals, and industrial minerals. The projections are fairly general, given the diversity of mining on public lands: the wide variety of mining methods, commodities extracted, geographic scope, and inherent uncertainty of commodities markets. These projections are based on historic trends in mining and current trends in commodity prices, exploration, and technological changes.

Precious Metals. Precious metals include gold, silver, and platinum group metals. As noted in Table 3-33, 88% of the $4 billion total value of precious metals mine production in the United States in 1998 was attributable to gold ($3.4 billion). Silver accounted for 9% ($339 million). And the platinum group metals (PGM)

Table 3-32. Ranking of Western States by Mine Production of Mineral Commodities - 1998[1]

	National Ranking					
State	**#1**	**#2**	**#3**	**#4**	**#5**	**#6-#10**
Alaska	Zinc	Lead Silver	Gold			
Arizona	Copper Molybdenum	Gemstones		Silver Zeolites	Pumice	
California	Asbestos Boron Diatomite Rare-earth metals	Feldspar Gold Magnesium Titanium	Perlite	Gemstones pumice	Gypsum	Silver (8) Talc (6)
Colorado		Molybdenum			Lead	Gemstones (8) Gold (6) Zinc (7)
Idaho	Antimony Garnet		Lead Molybdenum Pumice Silver			Feldspar (6) Gold (8)
Montana	Platinum Palladium Talc		Bentonite Garnet	Lead	Copper Molybdenum Zinc	Gemstones (10) Gold (6) Silver (6)
Nevada	Barite Gold Lithium Magnesite Mercury Silver	Brucite Diatomite	Gemstones	Copper	Gypsum Perlite	Lime (7)
New Mexico	Perlite Zeolites	Pumice	Copper Mica			Gypsum (10) Molybdenum (6)
Oregon	Pumice		Diatomite Zeolites	Perlite	Gemstones	
Utah	Beryllium concentrates	Copper Magnesium metal	Magnesium compounds Mercury	Molybdenum	Bentonite Gold Perlite Silver	
Washington			Magnesium metal	Diatomite		Gold (9)
Wyoming	Bentonite				Zeolites	

[1]Includes "locatable-type" minerals mined statewide regardless of surface ownership.Sources: USGS 1999a, b; Smith 1999.

Table 3-33. Precious Metals Value of Production 1998 ($000)

Commodity	Value	Percent of Total Value
Gold	$3,480,000	88%
Silver	3393,000	9%
Platinum Metals Group	136,000	3%
Total	$3,955,000	100%

Source: Smith 1999.

accounted for the other 3% ($136 million). Due to the overwhelming dominance of gold over other precious metals, the following analysis of trends in precious metals focuses on gold.

Production. Gold production in both the United States and worldwide has increased dramatically since 1980. In 1980, a total of 960,000 troy ounces was produced in the United States, accounting for 2.5% of worldwide production. By 1998, the United States produced a record 11.8 million troy ounces, accounting for more than 15% of worldwide production. Preliminary estimates for 1999 show that production has declined to 10.9 million troy ounces, but this is still higher than production in 1996 (see Figure 3-4).

More than 96% of current domestic production comes from the western United States, especially Nevada, which accounts for 75% of U.S. gold production. Four of the top five producing states are in the study area: Nevada, California, Alaska, and Utah, in that order. The U.S. Geological Survey estimates that gold is currently produced at 120 lode mines, a dozen or more large placer mines, and many smaller placer mines. Most of these placer operations are in Alaska. Of the domestic gold produced, the 30 largest mines yielded 92%, and 75 mines produced 98% of the total (Amey 1998). Of these top 30, a total of 27 are in the study area.

The most significant rate of increase in production occurred between 1984 and 1990, when gold production increased by an average annual 29% (from 2 million to 9.3 million troy ounces annually). Between 1992 and 1996, production was steady between 10.2 and 10.6 million troy ounces. The years 1997 and 1998 showed record production of 11.6 and 11.8 million troy ounces due to a significant amount of new capacity that had been in preparation during the previous 2 to 3 years before coming on-stream (Amey 1998).

Generally, gold mine closures are keeping pace with new gold mine openings and expansions in the United States At the same time the average output per mine has increased, resulting in a trend to fewer but larger U.S. gold mines. Most of the larger companies are replacing their annual production with new reserves, but smaller companies are finding this task more difficult (USGS 1998).

The United States is currently the world's second largest gold producer behind South Africa, which produced 19% of all gold in 1998 (down from more than half of total world production in 1980). Other significant producers are Australia (13%) (which ranks close behind the United States), Canada and China (7% each), and Russia and Indonesia (4% each).

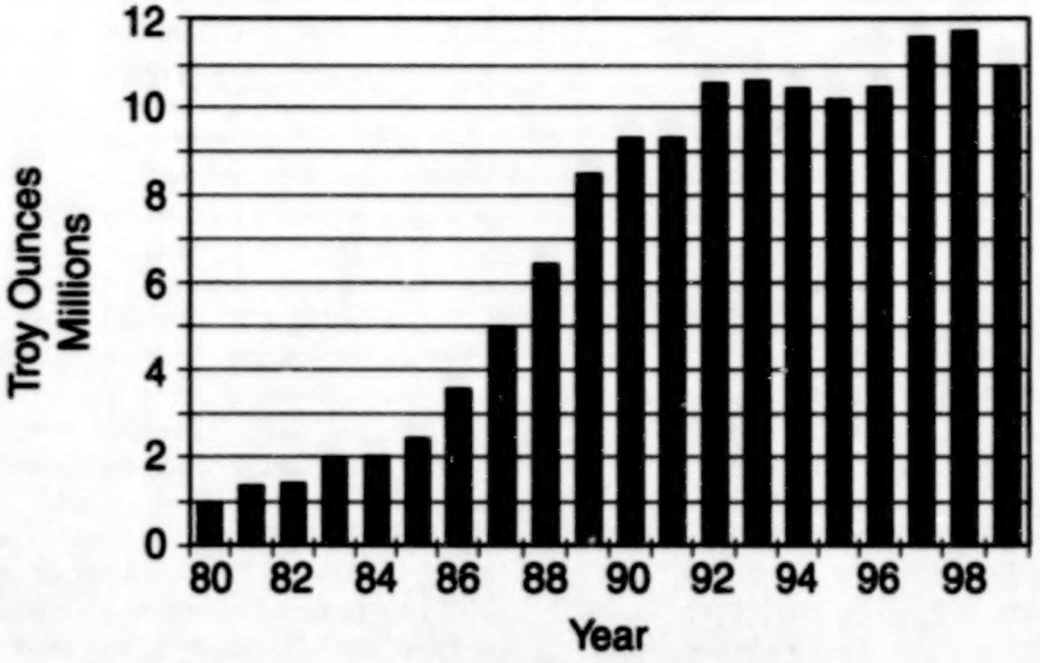
The dramatic increase in gold production worldwide over the past 20 years is attributable to a variety of factors:

- Technological changes in gold mining methods such as the refinement of heap leaching techniques and the extraction of gold from refractory ores.
- Long-term sustained increases in gold prices following the end of government price and ownership controls in the 1970s.
- Increased demand for gold.
- Increased access to deposits outside the United States.
- A large sustained increase in exploration for new gold discoveries in response to these changes.

The worldwide gold reserve base has increased by 145%, from just over 1 billion troy ounces in 1980 to 2.3 billion troy ounces in 1998. The U.S. reserve base more than

Figure 3-4

U.S. Gold Production 1980-1999



Source: Smith, 1998; USGS, various years(a).

tripled over that period (from 60 million to 193 million troy ounces). As a result, the United States' share of the worldwide base increased from 6% to almost 8%.

Exploration. Exploration expenditures worldwide and in the United States continue to be dominated by gold. In 1998, 55% of all exploration expenditures for nonferrous metals were estimated to have been spent looking for gold (Amey 1998).

Exploration in the United States peaked in the 1980s but is still considered strong. Domestic exploration (for all nonferrous metals) as a percent of worldwide exploration expenditures decreased between 1992 and 1998 (from more than 21% to 8.6%), but spending on a total dollar basis for most of that period remained steady (Wilburn 1998; Mining Engineering 1999). According to preliminary estimates for exploration spending in 1999, spending in the United States increased to about 10% of worldwide expenditures for nonferrous metals. On a total dollar basis, expenditures dropped to $216 million in 1999 from $243 million in 1998 (Mining Engineering 1999). Much of the domestic exploration for gold is aimed at replacing annual production at existing operations with new reserves rather than focusing on new discoveries.

In recent years the focus has shifted to other regions of the world, such as Latin America, Asia and the Pacific, and Africa. Many countries have revised their mining laws, are offering incentives for foreign investment, and in some cases have opened up areas previously closed to exploration. The transformation of centrally planned economies to market-based economies has also made deposits in these countries more attractive as investment opportunities (Amey 1997).

In addition to the "pull" of other countries as exploration targets due to economic and political reforms, there is also the view that permitting and environmental requirements in the United States are increasing costs and permitting times and thus are "pushing" exploration out of the U.S. (Dobra 1997; Fraser Institute 1998; Wilburn 1998).

Conversely, a recent study of the gold industry found that the U.S. is a relatively low-cost producer: "...[T]he world's largest producers other than the U.S., namely, South Africa and Australia, have the highest costs. U.S. producers, on the other hand, are the second lowest cost producers next to Brazilian producers, whose costs are very similar," (Dobra 1999).

Additionally, internationally recognized environmental standards are increasingly being required to secure funding for mining projects regardless of location (White 1997). These requirements would tend to offset to some extent the potential cost advantage of fewer permitting and environmental requirements.

Further, as noted in a recent study of the revival of the domestic copper industry in the 1980s, for the metal mining industry to succeed in the current economic environment, firms must constantly pursue new technologies and productivity gains (Tilton and Landsberg 1997) irrespective of permitting and environmental requirements of the host country. This quest has created a highly competitive global mining industry. Thus, the net effect of these factors on United States production is difficult to ascertain.

Prices. Gold prices play a significant role in the exploration and development of gold deposits. Between 1974–when the last of government price controls and restrictions on gold trading were abolished–and 1996 prices steadily and sometimes dramatically increased, peaking in 1980 at an average annual price of $613 (see Figure 3-5). From the late 1980s to 1996 the average annual price fluctuated within a relatively close range of $340 to $390 per troy ounce. But since the latter part of 1996 the price has trended downward rather significantly, hovering in the range of $280 to $300 since then.

The recent downward trend has been mainly attributed to the following: central bank sales; speculative selling; producer hedging; fears of future sales by central banks; and economic turmoil in Southeast Asia, Russia, and, more recently, Latin America.

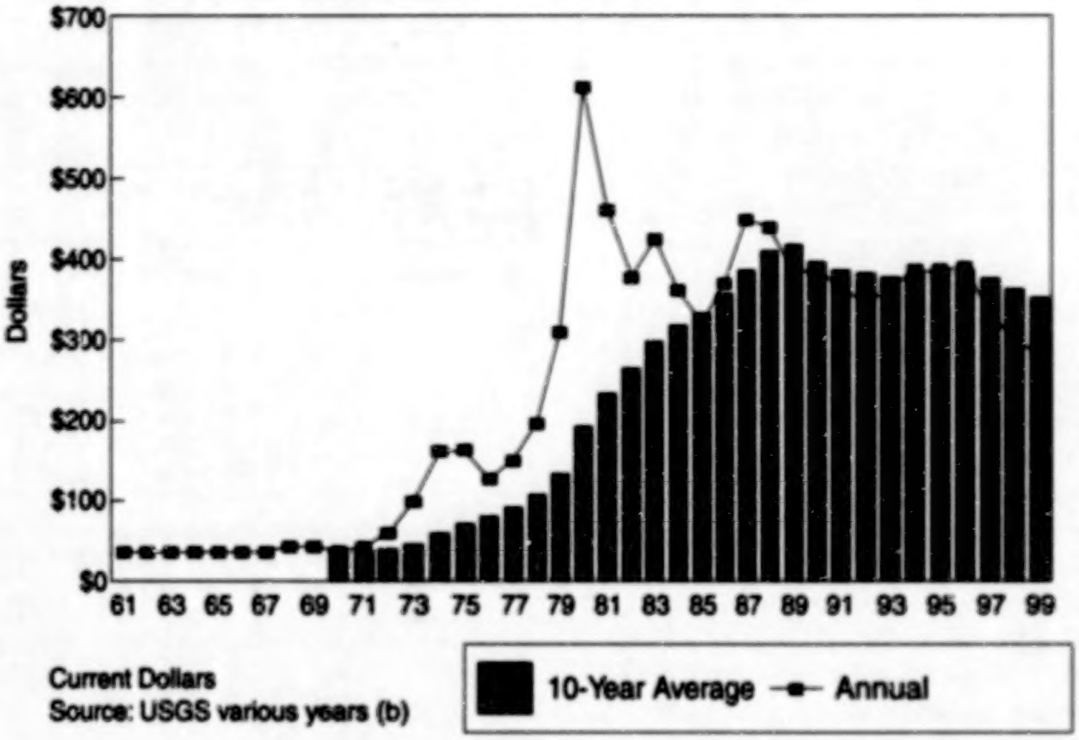
Global economic conditions are now showing signs of improvement, especially in Southeast Asia. The downward pressure on gold prices has occurred despite evidence of strong worldwide demand for gold, at least through 1998 (Murray 1998). Demand in 1999 appears to have declined due to lower demand for jewelry although demand increased for gold in coins and electronics.

Demand so far in 2000 appears to be strong (World Gold Council 2000). The near-term outlook is for an increased demand for fabricated gold and for the price to average about $280/oz (Gold Fields Mineral Services 2000). But continued apprehension about global economic conditions combined with recent gold market conditions makes the longer term outlook highly uncertain for gold prices and the market.

Projections. The gold market has a great deal of uncertainty, which has persisted since about 1996. Demand for gold has been strong in recent years (Gentry 1998) but not in all sectors. Demand for gold for jewelry fabrication, which accounts for about 75% of all gold demand, fell in 1999, and increased demand in other sectors did not completely compensate for that drop (Gold Fields Mineral Services 2000). Thus, overall worldwide fabrication fell about 1.4%. Improved international economic conditions are expected to contribute to an increase in demand of about 3.6%, at least during 2000 (Gold Fields Mineral Services 2000). Contributing to this demand will be population growth around the world, increased standards of living in many developing countries, and generally improving international economic conditions.

Figure 3-5

Average Gold Prices 1980-1999



Current Dollars
Source: USGS various years (b)

Beyond 2000, the situation is less clear. U.S. and worldwide exploration expenditures are expected to continue at lower levels than in the past due to low commodity prices. As less gold is discovered and old gold mines are closed, a gap may be created between the world's future gold supply and its demand, thereby creating excess demand (Amey 1998). This in turn could cause the price of gold to increase.

The globalization of mining opportunities has opened to exploration and development many areas that had previously been closed. Thus, worldwide supply of minerals such as gold are expected to increasingly originate from countries other than the United States. Nevertheless, interest in exploration in the western United States, especially Nevada, is expected to remain strong (Gentry 1998). The World Gold Council expects that future gold production will increase at a slower rate in the future than during the 1980s and 1990s, at 1.3% to 3% per year, in contrast to annual growth rates of over 4% for the past 17 years and growth rates in the 1980s exceeding 6% (Kral 1997).

Given the recent trend in steady domestic gold production, the dramatic increase in production opportunities outside the United States, worldwide demand for gold, the anticipated rate of growth in supply, and high level of uncertainty of gold prices and other market conditions, annual domestic production is expected to remain steady or slightly decrease for the foreseeable future. Further, the western United States, especially Nevada, is expected to remain the dominant region for production. Most of the existing large mines are expected to continue operating as depleted reserves are replaced. But lower exploration expenditures in the U.S. and worldwide may result in fewer mines being development in the future.

This scenario assumes that gold prices stabilize in the range observed over the recent past. An extended period of low gold prices, such as that experienced since 1996, or prices that drop even lower for a sustained period, may reduce gold production in the future. Lower prices tend to hit exploration first–this has already occurred both in the U.S. and worldwide–as well as smaller, high-cost producers. Some mines may close earlier as higher graded, lower cost ores are extracted and are not replaced by new reserves. But most of the larger, newer, low-cost producers are expected to withstand current gold market conditions. Conversely, a sustained significant increase in price would spur more exploration for new ore bodies and encourage extraction of lower grade ores at existing mines, thereby extending the life of many of these mines.

Up to 43% of total domestic production comes from public lands (including BLM and Forest Service lands). But a substantial portion of existing mines are awaiting patent approvals that would move them from public to private ownership. This patenting will decrease the portion of total domestic production from public lands in the foreseeable future. In the longer term, however, if public lands become permanently closed to patenting (a congressional moratorium exists on new patent applications), the portion of domestic gold production on public lands would likely begin to increase once again.

Pending Plans of Operations for exploration or development have been factored into these projections. Most of the current pending Plans are for precious metals exploration or development, and most of these are for expanding existing operations.

Base Metals. The base metals category includes a variety of minerals such as copper, lead, zinc, iron ore, molybdenum, and nickel. The base metals with the greatest production in the western United States are copper, lead, molybdenum, and zinc. As noted in Table 3-34, 65% of the $5 billion total value of U.S. production of the major base metals in 1998 was attributed to copper ($3.2 billion). Zinc accounted for 16% ($819 million), lead 10% ($480 million), and molybdenum 9% ($456 million). Because of the dominance of copper over other base metals, the analysis of trends in base metals will focus on copper. The copper trends are meant to generally represent trends for the other base metals as well.

Table 3-34. Base Metals Value of Production 1998 ($000)

Commodity	Value	Percent of Total Value
Copper	$3,220,000	65%
Lead	480,000	10%
Molybdenum[1]	455,000	9%
Zinc	819,000	16%
Total	$4,980,000	100%

[1] Figure for molybdenum is production value for 1996 since values for later years have been withheld to avoid disclosing company proprietary data.
Source: Smith 1999.

Copper Production. Between 1980 and 1998 copper production in the United States increased by more than 60%, from 1.2 million to 1.9 million metric tons annually (Figure 3-6). U.S. production accounted for 15% of worldwide production in 1998, about the same as its worldwide contribution in 1980 (and down from its 19% share in 1994). Domestic production, though increasing during the 1990s to record levels through 1997, decreased in1998 by about 4% to its lowest level since 1995 due to overcapacity and lower copper prices. Preliminary estimates for 1999 show continued decline in domestic mine production to about 1.6 million metric tons (USGS 2000).

Five western states accounted for virtually all (99.6%) domestic copper mine production in 1998. In descending order these states are Arizona (67% of all domestic production), Utah, New Mexico, Nevada, and Montana. Although copper was extracted from 38 mines, 15 mines accounted for 98% of all domestic production in 1998 (Edelstein 1998). In 1980, by contrast, 25 mines yielded 96% of all domestic production (USBM 1981). These statistics show that, like gold mines, copper mines tend to be decreasing in number but increasing in output.

Copper is mined in about 50 countries. With 15% of world production, the United States is the world's second largest mine producer behind Chile, which accounted for 30% of the 1998 worldwide production. Other major producers include Indonesia, Canada, and Australia. In total, the top 10 countries account for about 82% of worldwide production.

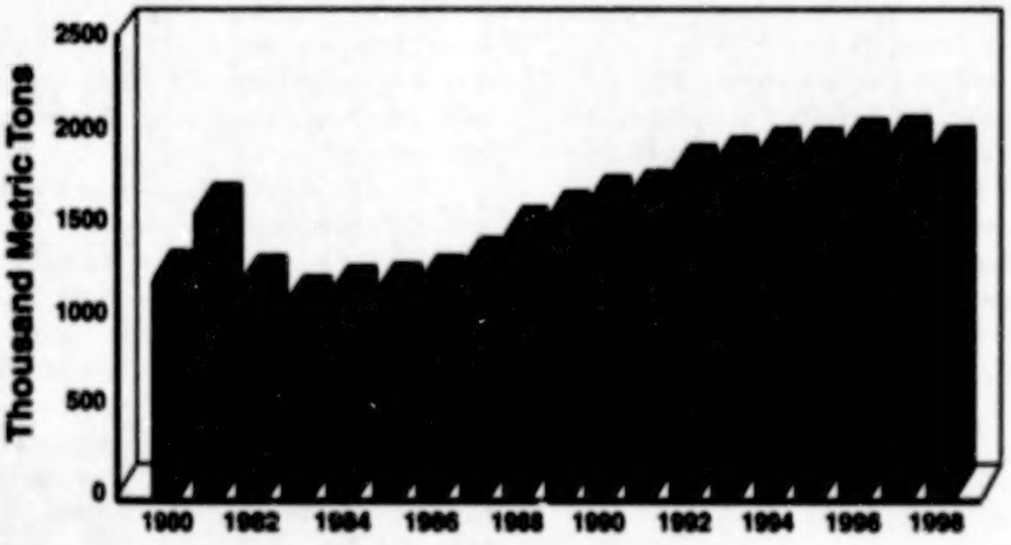
World production continued to increase to record levels, to 12.2 million metric tons in 1998. The bulk of increased production worldwide came from Chile, where mine production has increased by 85% since 1993 (Edelstein 1998) and where U.S. companies continued to invest heavily to expand production and reduce costs. In the mid-1990s, most U.S. copper mining companies reported record profits from copper operations owing to high production levels, lowered operating costs, and record-high copper prices. But declining copper prices beginning in 1997 have caused a large decrease in the total value of production and the closure of several mines (Edelstein 1998).

The worldwide copper reserve base has increased by 29%, from 505 million metric tons in 1980 to 650 million metric tons in 1998. But the U.S. reserve base has remained unchanged since 1980 at about 90 million metric tons. Consequently, as a portion of the worldwide base, the U.S. share has declined from 18% to about 13%. Most of the increase in the reserve base is due to new deposits discovered in Latin America, especially Chile (USBM and USGS various years).

Exploration. Preliminary data on exploration shows that exploration budgets for base metals in 1999 will make up about 37% of worldwide exploration expenditures, or $800 million, as reported by the Metals Economics Group (Wilburn 2000). Though this is a higher percentage than reported in 1997 and 1998 (27% and 33% respectively), on a total dollar basis, exploration expenditures are declining. Copper was the dominant target, comprising

Figure 3-6

U.S. Copper Production, 1980-1998



Source: USGS various years (a)

about 58% of all base metal expenditures (Wilburn 2000). The reduced level of exploration reflects lower prices and a continued oversupply of copper. Copper exploration in the United States is still centered in the West.

Projections. Beginning about mid-1997, new copper mining capacity coming online worldwide outstripped the growth in demand for copper that caused price declines and the closing of several large mines in the U.S. (mainly in Arizona and Nevada) and in other countries as well (Edelstein 2000; Silva 2000). There are indications that the demand-supply balance is improving, and this improvement should stabilize the industry for the near future. But conditions in the industry over the past few years and the closing of several U.S. operations are likely to result in little or no growth in copper mine capacity for the next few years.

Currently only 1% of domestic copper is mined on federal land, including land managed by BLM and other federal agencies, This is a much smaller percentage than is estimated for gold production on federal land (USDI 1993). This situation is also expected to continue because there is currently little exploration, and no Plans of Operations for copper are pending for public lands in Arizona, the dominant copper producing state (Kershaw 2000). New Mexico has only one pending Plan of Operations for copper mining, which is for expanding a mine (Dalness 2000).

Industrial Minerals. The industrial minerals category includes a wide variety of minerals with a great diversity of end uses. This category includes mainly all the nonfuel minerals not included as precious or base metals. Industrial minerals can generally be broken into subcategories related to their end uses. Many minerals, however, fit into more than one subcategory. For example, the *construction* subcategory includes minerals such as crushed stone, sand and gravel, pumice, gypsum, limestone, and some clays. Other subcategories include the following:

- *Chemical* (e.g. salt, lithium, iodine, bromine, strontium, and lime).
- *Agricultural* (e.g. potash, phosphate rock, sulphur).
- *Abrasives* (e.g. pumice, silica sand).
- *Fillers and extenders* (e.g. talc, mica, kaolin clay, graphite).
- A *miscellaneous* subcategory (including some high-value minerals such as titanium and rare earths).

Not all industrial minerals are locatable if found on public land. Examples of locatable industrial minerals include barite, bentonite, diatomite, feldspar, gemstones, gypsum, magnesium compounds, perlite, pumice, silica stone, talc, and vermiculite. Many other industrial minerals are considered either leasable or saleable: sand and gravel, common clays, crushed stone, some limestones, phosphate, potash, sodium (including soda ash), and sulfur. Leasable and saleable minerals are not locatable and are not included in this analysis or rulemaking.

The estimated value of locatable-type industrial mineral mine production attributable to the EIS study area was $2.4 billion in 1998. This estimate was derived from Table 3-30, which appears earlier in this chapter. Table 3-30 shows that "Other Metals and Industrials" totaled $4.2 billion in mine production value. But $1.8 billion of that amount can be attributed to base metals such as lead, molybdenum, and zinc. The remaining $2.4 billion can be attributed mainly to industrial minerals.

The large number of commodities in the industrial minerals category makes it difficult to assess the general trends in exploration and production for each mineral. It is also difficult to assess the general trends for the category of industrial minerals as a whole given the wide variety of end uses.

Nevertheless, an increase is expected in exploration and development of industrial minerals on western public lands in the foreseeable future for several reasons. First, the general overall growth in the domestic economy (and internationally) is fueling an increased demand for most of the end uses to which industrials are put. Second, many deposits of industrials previously on public land have already been transferred to private ownership through the patenting process. Therefore, future operations are expected to increasingly originate from public lands, assuming continuation of the congressional moratorium on new patenting. And third, generally speaking, many industrials are mined relatively close to where increases in economic activity and population growth are greatest, and many western states are experiencing rapid economic and population growth.

According to a 1993 Department of the Interior study, industrial minerals with more than 10% of total domestic production from federal lands (including federal lands not managed by BLM) include diatomite 53%, fullers earth 11%, gemstones 50%, pumice 14%, silica stone 25%, and talc 42% (USDI 1993).

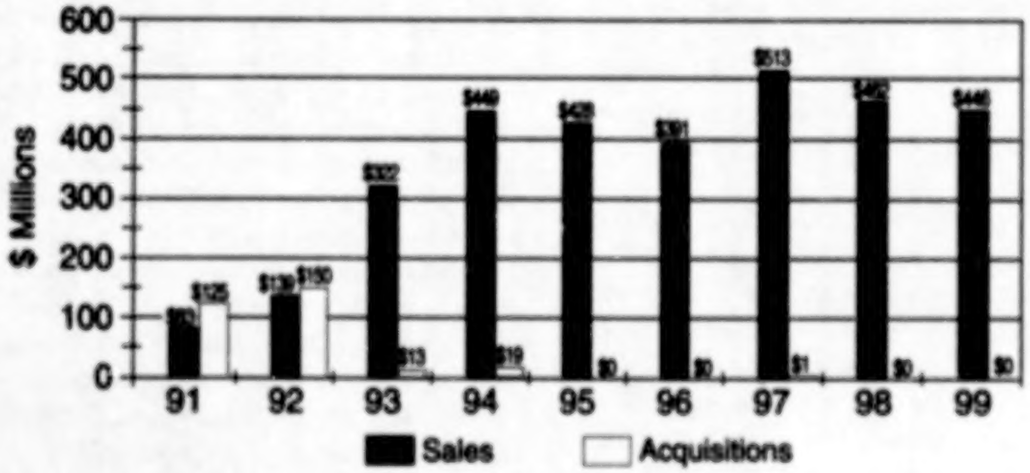
Currently several Plans of Operations are pending for industrial minerals, mainly for gypsum, limestone, silica sand, and cinder mines.

Strategic and Critical Materials. Strategic and critical minerals are those in which the United States is deficient or domestic sources are insufficiently developed to supply the military, industrial, and essential civilian needs of the United States for national defense. To reduce dependence on foreign sources in times of national emergency, Congress established the National Defense Stockpile (NDS) of strategic and critical minerals. Many of the minerals on the strategic and critical list are locatable-type minerals. Inventory of only a few of the minerals on the list, however, is lower than National Defense Stockpile goals, for example, cobalt, graphite, some gemstones, mica, and platinum group metals.

In recent years, the Defense National Stockpile Center, which operates as an international commodity broker of strategic and critical minerals for the U.S. Government, has been liquidating much of the stockpile, and the goals for maintaining inventory for many minerals have been eliminated, although the list

Figure 3-7

National Defense Stockpile Sales and Acquisitions, 1991-1999



Source: U.S. Department of Defense, various years.

remains (U.S. Department of Defense, Defense Logistics Agency 1997; Mory 1998). Figure 3-7 shows the level of annual sales from and acquisitions to the stockpile.

Contribution of Mining to the Regional and National Economy

The mining industry for locatable-type minerals is an important contributor to the economies of the western states, to the national economy, and especially to some counties in the study area with significant mining. The contribution to these economies can be measured in several ways:

- Value of mineral production (see previous section).
- Contribution to each state's gross state product and to national gross domestic product.
- Level of employment and personal income directly attributable to the mining industry.
- Number of mines.
- The multiplier effects, which estimate the indirect and induced economic effects of mining in addition to direct effects.
- Role of mining in the economies of mineral-rich rural communities.

The following section describes the economic contribution of locatable mine production overall for the study area (except where noted), not merely the portion from public lands. Locatable minerals production on public lands contributes an estimated 10% of the study area's total value of mine production overall, but this percentage varies by commodity.

Mining for metals and nonmetallic minerals in the study area collectively contributed $7.5 billion to the gross state product (GSP) in 1997, the latest year for which GSP data are available (BEA 1999). GSP is a state's sum of each of its industries' gross output less intermediate goods and services purchased from other industries or imported, also referred to as "value added." This $7.5 billion represents 0.5% of the study area's combined GSP of $1.62 trillion.

More significantly, however, the study area contributed 44% of the Nation's total gross domestic product (GDP) for the metals and nonmetallic minerals mining sectors combined. For the metals-mining sector alone, the study area contributed 74% of the Nation's total GDP (see Table G-1 in Appendix G). Gross domestic product is the sum of the GSPs for the 50 states.

Trends in mining's contribution to GSP since 1982 are uneven among the western states. (Note: Due to new indexing techniques used for estimating inflation-adjusted changes in gross domestic product and gross state product, 1982 is a more suitable base year for this trend analysis than 1980, which is the base year used for other statistics in this section.) For metals, most states increased their contributions to GSP between 1982 and 1997, as measured in 1992 chained dollars. But the contributions of two states–Colorado and Wyoming–declined.

Of the states showing increases, the change varied from a 33% increase in contribution to GSP in New Mexico to a 5,100% increase in Alaska. But on a total dollar basis, the largest increase in contribution to a state's GSP came in Nevada, where metal mining increased by $1.4 billion, from $199 million to $1.6 billion.

For nonmetals all states showed increases in the contribution to each state's GSP. Increases ranged from 5% in Nevada to 233% in Arizona. On a total dollar basis, California showed the largest increase, from $378 million in 1982 to $947 million in 1997, a $569 million increase. It is difficult to tell how much of the nonmetals category is attributed to locatable-type minerals. The nonmetal category in GSP includes many minerals, such as sand and gravel and many other construction-type minerals, that are not locatable and are not covered by this rulemaking. Many of these minerals are mined near construction sites. Because the West has been experiencing record population growth, much of the increase can be attributed to these construction minerals.

On the whole, the western states showed a 172% increase in metal and nonmetallic mining's contribution to GSP, from $2.8 billion in 1982 to just over $7.5 billion in 1997, as measured in 1992 chained dollars. This increase is the combined result of a 212% increase in metals and a 127% increase in nonmetals. During the same period, the combined GSP of the region increased by 69% overall. The net result is that the contribution of metals and nonmetals in the western states, *as a portion of the region's total GSP*, increased from 0.3% in 1982 to 0.5% in 1997.

Another measure of the contribution of locatable-type mining is in *personal income and employment*. This information is collected in detail by state and reported nationally by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). The study area's direct contribution of the metals and nonmetallic minerals mining industries was $3.3 billion in personal income (Table G-2 in Appendix G) and 67,000 jobs in 1998, the latest year for which data are available. This amount represents about 2% of the study area's total personal income and employment, which is proportionately greater than these sectors' contribution to area GSP. Total personal income nationally for metals and nonmetal mining combined was $8.2 billion in 1998. The study area's contribution of $3.3 billion represents 40% of these sectors nationally.

The Bureau of Labor Statistics (BLS) also reports employment levels and trends. BLS figures do not match BEA figures due to differences in data collection. Although BEA and BLS employment figures don't match in absolute numbers, these two data sets do show similar trends for levels of mining employment and mining's share of total employment, both at the state and national level.

During the 19-year period from 1980 through 1998, BLS data show that metal mining employment in the study area declined by 44 %, from 65,000 to 36,000 jobs. This amount tracks the national trend, which showed a 51% decline over the same period. Employment in nonmetallics declined by 17% in the study area, compared to an 11% decline nationwide. At the same time, overall employment in the study area increased by 54% (Bell 2000). This decline shows that mining employment has become a smaller portion of total employment over the past 19 years, even while mine production has increased significantly over that period (see Table G-3 in Appendix G).

There are exceptions to these trends. The most obvious counter-trend has occurred in Nevada, where metal mining employment increased by 216% from 3,600 jobs in 1980 to 11,500 by 1998. Nevada currently contributes nearly a third of all metal mine employment in the study area, virtually all related to gold mining. (Nevada and Arizona combined contribute 61% of all metal mining employment. Arizona's employment is attributed mostly to copper mining.)

Alaska also shows a significant increase of 294% in metal mining employment, but the state overall contributes only 3% of all current metal mining employment in the study area. In nonmetallic mineral production, Arizona, Colorado, and Washington showed significant increases (60%, 110%, and 47% respectively). Many nonmetallic minerals are not considered locatable minerals on public lands.

While overall trends in employment and income in the metal and nonmetallic mineral mining industries show declines, these trends alone would tend to understate the importance of these sectors to the economies of the western states and the Nation as a whole. These employment and personal income figures represent the *direct* impact the metal and nonmetallic mining sectors have on the regional and national economies.

In addition to direct employment and income effects, these industries purchase capital equipment for mine development, buy operating supplies and business services, and hire workers who in turn spend their incomes on goods and services. These added spending levels create a *multiplier effect*, which accounts for indirect and induced effects as well as direct effects. The sum of direct, indirect, and induced effects is the multiplier effect, or total economic impact.

The IMPLAN input-output modeling system was used to estimate the total economic impact of locatable mineral production on public lands in the study area for 1998 mine production. (These impacts are based on the 10% of the total value of mine production estimated to originate from federal lands.) The

$1.7 billion in production value is estimated to have contributed the following:

- $3.1 billion dollars in *total industry output.*
- $1.4 billion in *total income* (of which $766 million is employee compensation).
- $1.6 billion in *value-added.*
- 21,310 jobs overall to the study area (see Table 3-35).

The greatest impact is from mining in Nevada, where 59% of all total industry output and half of all jobs are located. Nevada's dominance is due to its large amount of gold produced from federal land.

Total industry output measures the total economic impact of purchases (e.g. capital equipment purchases and operating expenditures) within the study area by the mining industry to mine locatable minerals in 1998.

Total income impacts translate the impact of changes in expenditures by the mining industry into changes in income. Income includes employee compensation, proprietary income, and other property income. Employee compensation, as a subset of total income, represents total worker income generated by mining industry expenditures.

Employment impacts represent the total number of jobs generated by final demand expenditures by the mining industry in the study area, as measured by both full- and part-time jobs. Appendix G, Methodology for Estimating Contribution of "Locatable-Type" Mineral Production on the Economies of the 12 Western States, explains how these estimates were derived using the IMPLAN input-output model.

A variety of other recently completed studies have measured the economic impact of the mining industry. One study, ***The U.S. Gold Industry 1998***, found that in 1997 gold and silver production nationwide contributed $7.7 billion in output, $2.3 billion in earnings, and nearly 84,000 jobs (Dobra 1999). The study notes that most of this impact is due to mine production from the western states.

This study and the IMPLAN impacts mentioned above use different models and thus produce different results. The Dobra study focuses on gold and silver and includes all land

Table 3-35. Estimated Regional Impacts from Production of Locatable Minerals on Public Lands 1998 ($000)

		Personal Income			
State	**Total Industry Output**	**Total**	**Employee Compensation**	**Value Added**	**Employment (Jobs)**
Alaska	$144,000	$65,800	$30,500	$83,800	970
Arizona	40,600	20,500	12,200	24,100	320
California	142,000	76,500	46,500	83,800	1,020
Colorado	57,600	28,400	16,300	33,800	350
Idaho	69,400	35,300	20,700	41,800	680
Montana	61,700	29,300	18,200	37,600	410
Nevada	1,810,000	830,000	466,000	908,000	10,740
New Mexico	32,000	12,000	5,500	16,600	220
Oregon	1,250	500	900	1,000	10
Utah	49,200	20,900	11,100	25,700	360
Washington	19,900	11,900	7,600	13,300	130
Wyoming	3,500	1,800	900	2,500	30
12-State Area	$3,080,000	$1,390,000	$766,000	$1,590,000	21,310

Note: These estimates include only production estimated to originate from federal lands. Figures rounded to three significant digits. Source: IMPLAN Input-Output Modeling System (see Appendix G).

ownership types. The IMPLAN analysis in this EIS includes most locatable minerals and only the portion estimated to be mined from public lands.

A similarity of these two results is that measuring the multiplier effect state by state misses the economic impact that a mining company makes in states outside the area modeled, a limitation noted in *The U.S. Gold Industry 1996* (Dobra 1997). For example, capital equipment purchases by a mining company in Nevada from a firm in Illinois would not show up as an injection into the Illinois economy unless Illinois were part of the study area modeled. Consequently, some economic contributions from mining investment are understated at the national level. This understatement is not unique to mining impacts, however. Assessing the economic impact of one sector within a state on that state's economy is subject to this limitation.

Another study, published by the National Mining Association, estimated the economic impact of the solid-minerals mining industry (Leaming 1997). This study, which includes minerals such as coal and many nonlocatable types, estimated that the western states generated $115 billion and 1.1 million jobs in 1995, or 37% of the total U.S. impact of solid-mineral mining of $524 billion and 22% of the estimated 5 million total jobs. The data and methodology used in this study differ substantially from the multiplier analyses described previously. The figures from the two studies cannot be compared, but the Leaming (1997) study provides a useful comparison of the western mining industry in relation to the national industry.

Mining is also important to many rural communities and counties in ways that are not captured by looking strictly at its contribution to the state or regional economy. Many western counties have significant amounts of locatable mining. This mining contributes a disproportionate share of local employment and income in relation to the industry's contribution statewide.

One way to measure this contribution is by using a "location quotient." A location quotient is simply a ratio of a county's percent employment in a particular industry to the statewide percent employment in that industry (USFS and BLM 1998). A location quotient greater than 1 shows that the county is specialized in that industry. The greater the quotient exceeds 1, the greater the degree of specialization.

Using standard Bureau of Economic Analysis (BEA) employment data, one can determine location quotients only for the mining sector as a whole because employment data is not reported in greater detail as, for example, for metal mining. But estimating location quotients using BEA personal income data rather than employment data does allow for greater industry detail. For this reason, BEA personal income data is used in this analysis rather than employment data to show why the level of specialization in metal and nonmetallic mining for counties in the study area can be an important issue.

The area encompassing the Carlin Trend in Nevada gives a good example of how important mining can be to local economies. Mining in the Carlin Trend area most immediately affects Elko and Eureka counties. In this area most of the metal mines are in Eureka County, but most mine employees live in Elko County. (Other mines in these two counties but not on the Carlin Trend are also included in the analysis.)

In 1998 metal mining contributed $324 million personal income to the area, about 29% of the area's total personal income of $1.1 billion. In contrast, metal mining provided 1.4% of total personal income statewide ($705 million of the state's total personal income of $50.9 billion). The location quotient for employment in the Elko-Eureka counties area, then, is 21 (29% divided by 1.4%), showing a high degree of mining specialization for the area.

Further evidence of the importance of mining to this area (and other western rural areas whose mining employment has grown) is the rate of growth since 1980. In 1980 personal income for mining overall (data was unavailable for metal mining) represented 10% of all income for the two-county area. With mining contributing 1.8% to statewide employment during that time, Elko and Eureka counties had a combined location quotient of 5.7 in 1980. So at a time when the statewide and westwide economies have been growing more diversified, the Elko-Eureka counties area has become more dependent on mining.

BLM recognizes that other counties in the western U.S., not just the Elko-Eureka counties area, would also have location quotients much greater than 1, showing a high degree of specialization in mining. Also, counties not currently specialized in mining could become so in the future if mines were to be developed there. The Elko-Eureka counties example is presented simply to show how location quotients can be used.

Description of Mining Operations

The wide variety of mining and milling methods depends on the type of mineral mined and physical properties of the deposit. Representing all of these variations in one programmatic study is not practical. Appendix E describes seven "typical" operations for exploration and placer, open pit, underground, and strip mining. These descriptions are not meant to represent an entire industry using a particular method but instead are meant to represent "typical" operations that could reasonably be expected on public lands. Also, exploration, placer, open pit, and strip operations are the most common types of mining for locatable minerals on public lands.

These models describe the mining method, mineral deposit, size of operation, mine life, and other characteristics. The purpose of the models is to further describe how operations might be affected and the costs they might result from the proposed regulation changes and alternatives.

Use and Nonuse Values

In addition to economic activity of public lands mining, the value of nonmining environmental resources, amenities, and uses is also important. The types of resources and amenities that could be considered in an economic impact analysis of mining regulations could be extensive. For example, impacts to the following all have economic implications: fish and wildlife populations, habitat, water quantity and quality, recreation, scenic quality, endangered species, ecosystem functions, biodiversity, and air quality.

Most of these resources have more than one type of value, generally called "use" and "nonuse" values. Use value refers generally to consumption value, for example, the economic value (e.g. expenses) of hunting elk or hiking in a wilderness area. Nonuse value is independent of use. Nonuse values might consist of the value one may place on preserving a population of endangered species or on preserving a scenic view for future generations (Freeman 1993).

Use values are generally observed through the activities of markets where prices are set for goods and services. Nonuse values can be defined "... as an individual's willingness to pay to preserve or maintain a resource..." beyond what he has already paid for that resource in the market (Freeman 1993). For environmental resources and amenities, markets in many cases do not exist or are not well defined. Consequently, use and nonuse values are difficult to determine.

Wildlife-related recreation serves as one good example of the value of environmental resources and amenities. A recent survey by the U.S. Fish and Wildlife Service estimated that expenditures for hunting, fishing, and wildlife viewing in 1996 totaled nearly $9 billion in the study area (FWS and Bureau of the Census 1997). Expenditures include lodging, transportation, and eating expenses; purchases of hunting and fishing equipment; binoculars; and a wide variety of other expenses. Expenditures by state are listed in Table 3-36.

Table 3-36. Expenditures for Wildlife-Related Recreation in Study Area 1996 ($000)

Alaska	$781,000
Arizona	1,029,000
California	2,397,000
Colorado	792,000
Idaho	146,000
Montana	219,000
Nevada	263,000
New Mexico	429,000
Oregon	693,000
Utah	237,000
Washington	1,661,000
Wyoming	235,000
TOTAL	$8,882,000

Note: These values include all lands within the states in the study area and are not intended to represent values only for BLM-administered lands.
Source: FWS and Bureau of the Census 1997.

These recreation expenditures are one example of use value for fish and wildlife. Other use values that should be considered for fish and wildlife include commercial production such as commercial fisheries, and subsistence value–the value to American Indians of fish and wildlife for noncommerical uses (Flather and Hoekstra 1989; BLM 1988b).

Nonuse values, which are independent of expenditures, take various forms:

- Option value–the value a person places on a resource to preserve it for possible future use.
- Existence value–the value a resource has even though the person will never use it.
- Bequest value–the value a person places on a resource to preserve it for future generations.

The sum of use value and all nonuse values for a particular resource is that resource's total value (Freeman 1993).

Recognizing both use and nonuse values for environmental resources is important. But quantifying these values for all the nonmining resources in this EIS would be difficult at best for several reasons:

- Data for many resources either do not exist or exist only for site-specific areas.
- The number of resources and amenities to consider is large.
- The study area is large.
- "Markets" do not exist for many of these resources, and their values are virtually impossible to determine (as, for example, a plant or insect that may have no apparent current value, but for which a valuable use may be discovered in the future).

But the EIS does consider the impacts of the regulations and alternatives to environmental conditions for a wide variety of resources. In that sense, this EIS does portray the tradeoffs between mineral activity and environmental conditions across the alternatives.

Environmental Consequences

Introduction

Appendix E details the analysis used to estimate changes in overall mining activity for each of the alternatives. Additionally, it provides mine cost models detailing how each of the five alternatives might affect the cost structures and requirements for seven typical mining operations. These scenarios are hypothetical and are given for descriptive purposes only. They are not meant to portray any particular mining operation or any specific state's permitting process. They should be viewed as simply illustrative of changes a mining operation might experience under these alternatives.

Alternative 1: No Action

The No Action Alternative is not expected to have any overall effects on trends in mineral exploration and development as described in the previous section. Over the long term, exploration for and development of precious metals, particularly gold, are expected either to continue at levels of the recent past or to slightly decrease. This projection reflects the following:

- Recent trend in steady domestic gold production.
- Dramatic increase in production opportunities outside the United States.
- Worldwide demand for gold.
- Anticipated rate of growth in supply.
- High level of uncertainty of gold prices and other market conditions.

This projection assumes that the price of gold stabilizes in the range observed over the recent past.

But the current gold market is characterized by low prices (which have persisted for about 2 years) relative to the past 20 years, coupled with lower than expected demand from Southeast Asia due to that region's economic problems. Consequently, the short-term outlook for gold production remains uncertain.

For base metals, particularly copper, there is likely to be little or no growth in mine capacity for the next few years. For production of industrial minerals, the western United States will likely see an increase in activity overall on all types of land ownerships including public lands. The overall projections in production of precious, base, and industrial minerals are based on trends in those commodity markets and do not necessarily coincide with the expected number of future Notices and Plans of Operations.

Alternative 2: State Management

Overall and over the long term, mineral activity could increase up to 5% from current levels across the study area after the State Management Alternative is fully implemented. Changes in performance standards and environmental review for some states would be the primary drivers of increased activity for most types of small operations (e.g. exploration, placer, open pit, and underground) as well as for large underground and for most industrial mineral mining.

But because states would have discretion on when and how to apply performance standards, it would be difficult to specifically describe the impacts from exercising this discretion. For larger operations (especially exploration, placer, and open pit) changes in administrative requirements and changes in performance standards would be more evenly split in their impacts on operations.

Under Alternative 2 BLM would neither review nor approve any specific project because the states would regulate mineral activities on BLM-administered lands. Administrative elements likely to have the greatest effect are the content and processing requirements for Notices and Plans of Operations and the 5-acre threshold for Plans of Operations, since BLM would no longer require Notices and Plans. Time delays due to preparing EISs would be reduced or eliminated in most states. But California, Montana, and Washington have state laws similar to the federal National Environmental Policy Act (NEPA), under which EISs would still be prepared. In these three states there would likely be little time advantage to implementing this alternative.

Assuming a 5% increase in mining, the value of mine production of locatable minerals would increase up to an estimated $85 million across the study area. This level of increased production would contribute up to 1,070 more jobs to the region, $154 million more in total industry output, $70 million more in total personal income (of which $38 million would be employee compensation), and $79 million more in value-added.

Table 3-37 shows the regional economic impacts by state and for the study area overall. For the study area's total current value-added as measured by gross state product (GSP), this amount represents a 1% increase in the metals and nonmetallic sectors. Most states would likely see increased levels of activity on public lands. But on the basis of the current level of production, Nevada is estimated to produce the largest increase ($90 million in industry output), more than half the gain for the study area as a whole.

These economic impacts assume an increase of up to 5% in activity overall. States, such as California, Montana, and Washington, that have National Environmental Policy Act-type review provisions might not realize an increase because there would likely be no time advantage for this alternative. Also, some states have environmental protection regulations similar enough to the 3809 regulations that mining might not realize significant cost reductions.

The estimated increase in overall production would result from a variety of responses by the mining industry, holding constant other factors (e.g. technology, commodity prices, and political and economic conditions for mining in other countries). Some deposits considered to be subeconomic might under the State Management Alternative be considered economically feasible with a higher likelihood for development, either as extensions of existing mines or as new mines. Or more new mines might come on-line due to increased exploration or lower costs for obtaining permits.

Commodity prices would not be likely to change in response to a 5% overall increase in production because prices for most mineral commodities are determined on world markets and individual production decisions do not affect prices. For commodities whose prices are not determined on world markets (such as some of the industrial minerals), it is assumed that the prices are established on local markets and increases in production from public lands would not be sufficient to affect these prices.

Rural communities might or might not be affected, depending on a variety of factors: the level of current local mining; a community's degree of dependency or "specialization" in mining subject to the 3809 regulations; and the size of the community, its isolation, and other factors. Except in Nevada, small rural communities in most states are expected to experience only a small increase in number of jobs and output relative to overall employment and output levels. Increases might be due to expanding existing operations or starting new operations. Small expansions or small new mines might little affect communities whose population and labor force are already in place to fill new jobs. Smaller, more-isolated communities experiencing a new mine might suffer "growing pains" and new demands on local services from a large influx of new workers and their families.

In Nevada, impacts to rural communities might be greater than in other states due to the greater estimated increase in activity (up to 550 jobs and $90 million in industry output). But again, the impact to any particular community in the state would depend on whether the impact is due to the expansion of existing operations or to entirely new operations. Many of the more established communities (e.g. Elko/Eureka Counties, Humboldt County) might be better equipped to handle an influx of new jobs of this magnitude because they have had more experience with mining-induced growth over the past 20 years. Nevertheless, significant impacts might result.

The estimates of impacts assume full implementation of the alternative and no significant changes in current state requirements. Any impacts at the community level would not likely occur in the short term since new mining operations and expansions would take some time to come online.

Alternative 3: Proposed Action

Under the Proposed Action, mining activity in the study area could decrease between 5% and 30% from current levels after full implementation of this alternative, and assuming current trends in mining continue for the foreseeable future. The degree of impact would vary by state depending mainly on the dominant types of mining and/or commodities mined in each state. For example, in states with relatively little metal mining (Oregon, Washington, and Wyoming), the estimated decrease in value of production would be lower (-5% to -15% in Oregon and Wyoming; -5% to -20% in Washington) than for states with relatively greater amounts of metal mining (-10% to -30% in Arizona, Colorado, Montana, Nevada, New Mexico, and Utah; -10% to -20% in Alaska; and -10% to -25% in California).

For most types of smaller exploration and mining operations (i.e. less than 5 acres), the main components of the proposed regulations affecting mining would be new administrative

BLANK

PAGE

Table 3-37. Alternative 2 (State Management) Estimated Total Regional EconomicActivity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$118,000	$124,000	$144,000	$151,000	$65,900	$69,200	$30,500	$32,000	$83,800	$88,000	970	1,020
Arizona	49,900	52,300	40,800	42,600	20,500	21,500	12,200	12,800	24,100	25,300	320	340
California	97,100	102,000	142,000	150,000	76,500	80,300	46,500	48,800	83,800	88,000	1,020	1,070
Colorado	40,100	42,000	57,800	60,500	28,400	29,800	16,300	17,100	33,800	35,500	350	370
Idaho	55,300	58,100	69,400	72,900	35,300	37,100	20,700	21,700	41,800	43,900	680	710
Montana	45,900	48,200	61,700	64,800	29,300	30,800	18,200	19,100	37,600	39,500	410	430
Nevada	1,170,000	1,230,000	1,810,000	1,900,000	830,000	871,000	466,000	490,000	908,000	953,000	10,740	11,280
New Mexico	25,600	26,900	32,000	33,600	12,000	12,600	5,500	5,780	16,600	17,400	220	230
Oregon	2,010	2,110	1,250	1,310	500	525	900	945	1,000	1,050	10	11
Utah	70,300	73,900	49,200	51,700	20,900	21,900	11,100	11,700	25,700	27,000	360	380
Washington	18,300	19,300	19,900	20,900	11,900	12,500	7,600	7,980	13,300	14,000	130	140
Wyoming	5,240	5,510	3,500	3,680	1,800	1,890	900	945	2,500	2,630	30	30
Study-Area Total	$1,700,000	$1,780,000	$3,080,000	$3,230,000	$1,390,000	$1,460,000	$766,000	$804,000	$1,590,000	$1,670,000	21,310	22,380

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$0	$5,910	$0	$7,190	$0	$3,300	$0	$1,530	$0	$4,190	0	50
Arizona	0	2,490	0	2,030	0	1,030	0	610	0	1,210	0	16
California	0	4,850	0	7,120	0	3,830	0	2,330	0	4,190	0	50
Colorado	0	2,000	0	2,880	0	1,420	0	815	0	1,690	0	18
Idaho	0	2,770	0	3,470	0	1,770	0	1,040	0	2,090	0	30
Montana	0	2,300	0	3,090	0	1,470	0	910	0	1,880	0	21
Nevada	0	58,500	0	90,400	0	41,500	0	23,300	0	45,400	0	540
New Mexico	0	1,280	0	1,600	0	600	0	275	0	830	0	11
Oregon	0	101	0	63	0	25	0	45	0	50	0	1
Utah	0	3,520	0	2,460	0	1,050	0	555	0	1,290	0	18
Washington	0	917	0	995	0	595	0	380	0	665	0	7
Wyoming	0	262	0	175	0	90	0	45	0	125	0	2
Study-Area Total	$0	$84,900	$0	$154,000	$0	$69,500	$0	$38,300	$0	$79,400	0	1,070

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 50, except figures under 25. Source: IMPLAN Input-Output Modeling System.

requirements designed to increase resource protection. For example, all mining operations, regardless of mining method used, that now have to file only Notices would under the Proposed Action be required to submit Plans of Operations.

Exploration disturbing less than 5 acres would also be required to file Plans of Operations under certain circumstances, such as if located in special status areas. This requirement would increase the workload, time, and cost of obtaining approval for mining and exploration. But the degree to which workload, time, and cost would increase would depend on the type of operation and the reason a Plan would be required instead of a Notice.

In addition, new filing requirements for Plans of Operations, such as for more data, would increase costs for data collection and possibly take more time than now is the case. Longer permitting times would also be more likely for operations within withdrawn areas because of the need for mining claim validity examinations before BLM would approve mining permits.

New requirements for bonding constitute another administrative area that would increase costs for smaller Notice-level operations. Although new bonding requirements would affect all types of operations, those most affected would be small operations (e.g. exploration, placer, small open pit, and underground). These impacts would mainly be due to bonding amounts and the requirement that the bond instrument be filed with BLM.

No longer allowing corporate guarantees to satisfy bond requirements would affect some larger operations. Current corporate guarantees would not be affected, but such guarantees would not be allowed in the future. The cost of bonding would increase for operations that use corporate guarantees. This impact would be concentrated in Nevada, where corporate guarantees are now allowed and many large mining companies are using them.

Generally, the performance standards under the proposed regulations are expected to have a relatively larger impact on future large operations (i.e. greater than 5 acres) than the administrative-type provisions. Of the performance standards, the requirement to avoid substantial irreparable and unmitigatable harm to significant resources has the greatest potential for affecting mineral activities (both large and small). In some cases, this provision could preclude operations altogether. For example, if BLM determines that avoiding substantial irreparable harm would require complete backfilling of an open pit and the operator considers that requirement infeasible, the mine would not be developed. As a another example, if determining that a proposed operation would substantially, irreparably, and unmitigatably damage "significant" cultural resources, BLM would not approve the Plan of Operations.

We assume that BLM would rarely deny a Plan of Operations or reject a Notice on the basis of the substantial irreparable harm provision for most resources. On the other hand, concerns about Native American religious and cultural issues may mean that the provision may be extensively applies as it relates to those concerns. Thus, there is great amount of uncertainty associated with the substantial irreparable harm standard.

The performance standard for pit backfilling is another provision that could affect small and large open pit operations. But the presumption of backfilling has been dropped from the Proposed Action, so the likelihood of backfilling is lower than as analyzed in the draft EIS. With respect to Nevada, the proposed backfilling provision is similar to existing requirements in that state and is expected to have little effect.

Other performance standards are also expected to affect operations, especially those addressing leaching operations, surface and ground water protection, and acid-forming-type materials. But these standards would not affect operations as much as would the standard for pit backfilling, if an operation were to be required to backfill. Standards for revegetation and protection and restoration of fish and wildlife habitat are expected to have their greatest impact on small exploration and placer projects.

The value of mine production originating from public lands under the Proposed Action is estimated to decrease by 10% to 30%, or by $169 million to $484 million across the study area. This level of decreased production would cause the following decreases across the study area:

- 2,100 to 6,050 jobs.
- $305 million to $877 million in total industry output.
- $138 million to $396 million in total personal income (of which $76 million to $218 million is employee compensation).
- $157 million to $453 million in value-added.

Table 3-38 shows the regional economic impacts by state and for the study area overall. For the study areas's total current value-added as measured by gross state product (GSP), this $157 million to $453 million would represent a 2% to 6% decrease in GSP-related value in the metals and nonmetallic sectors.

Most states would see decreased levels of mining on public lands, ranging from $101,000 to $302,000 in Oregon to $117 million to $351 million in Nevada. Nevada's share of the loss would be 70% of the loss for the study area as a whole. With the exception of the substantial irreparable harm standard, however, Nevada's existing regulations already incorporate most of the provisions of the Proposed Action.

Further, the impacts in Nevada are based only on the portion of production coming from public lands. To the extent that the affected portion from public lands may affect a larger portion of production coming from non-BLM lands, the impacts to Nevada may be understated.

A 10% to 30% overall decline in mineral production from current levels would result from a variety of responses by the mining industry. Some potential future operations would now be considered subeconomic and therefore would not be developed. Future operations might have shorter mine lives. Or current operations that might expand under these new regulations might close sooner than they otherwise would, holding constant other factors such as technology, commodity prices, and political and economic conditions for mining in other countries. A lower level of exploration due to more restrictions would also tend to decrease opportunities for future development, so some deposits would not even be found.

Economic theory suggests that mines would cease production when operating costs exceed gross revenue. The effects on any particular firm are difficult to determine without detailed information about that firm's production costs, capital structure, and nature and extent of its activities. In the extreme case, however, some firms could decide to cease production, either permanently or until commodity prices rise enough to make production profitable. But existing operations would be "grandfathered" and would continue to operate under existing regulations. Regulations under the Proposed Action would apply only to future plans to expand existing operations, and most current operations would be unaffected.

This analysis is based on (1) BLM's best estimates of potential overall reductions in the level of production of mineral commodities and (2) estimates of increased costs borne by firms. But aggregate levels of output might not change, given more efficient mining and reclamation techniques or other changes in market conditions. Total quantity produced could remain unchanged. Alternatively, the regulatory cost burden imposed by the proposed regulations could be overwhelmed by other market forces–such as commodity prices–that might play a relatively more important role in miners' production decisions.

Further, BLM would not implement the regulations in a static environment. Both miners and BLM would probably become more efficient at complying with the regulations over time. In the long run the regulations might even create incentives for firms to seek new lower cost approaches to mining and reclamation. This is a reasonable assumption given the inclination most firms have to constantly seek least-cost technology and business practices.

This assumption implies that the costs of the regulations could decline over time.

Commodity prices would not be likely to change in response to a 10% to 30% decline in production because the prices for most mineral commodities are determined on world markets and individual production decisions do not affect prices. For commodities whose prices are not determined on world markets (such as some industrial minerals) prices are assumed to be established on local markets, and changes in public land production are assumed not to affect these prices. Further, impacts to industrial mining are expected to be lower (-5% to -10%) than impacts for the study area overall.

Rural communities might or might not be affected, depending on a variety of factors: the current local level of activity; the degree of dependency or "specialization" a community may have in mining subject to proposed regulations; and the size of the community, its isolation, and other factors. Except possibly in Nevada, small rural communities in most states would lose only a small number of jobs and output relative to overall employment and output levels. And some or all of this decrease might be due to forgone future mining rather than current operations shutting down, or closing earlier than originally planned due to a reduction in economic reserves. In other words, the Proposed Action might not affect current mining in these communities, but in the future, new mines might not be developed.

In Nevada, impacts to rural communities might be greater than in other states due to the greater estimated decrease in activity (1,050 to 3,200 jobs and $181 to 543 million in industry output). But how any particular community in the state would be affected would depend on whether the impacts result from existing mines closing prematurely or potential operations not being developed. Any impacts at the community level would not likely occur in the short term while the proposed regulations are being implemented because mines with existing permits would not be affected unless they amend their Plans of Operations.

Alternative 4: Maximum Protection

Mineral production across the study area could decrease between 10% and 75% from current levels after full implementation of Alternative 4, depending on the mining method used. Open pit mining is expected to be affected most heavily (a decrease of 50% to 75%). Exploration is estimated to decrease by 20% to 30%, placer mining by 15% to 30%, underground mining by 10% to 25%, and strip mining by 10% to 25%.

Generally, the performance standards would have the greatest impact on the economy. They would most heavily affect open pit and large underground mines, which include most of the precious- and base-metal operations. Each performance standard would have the potential to significantly affect current and future operations, although not to the same degree. Mandatory pit backfilling, for example, would substantially increase costs for most open pit mines because most operations do not backfill or they backfill only partially. Provisions for surface and ground water protection, and for acid-producing processes would also substantially affect open pit and underground mines, making some proposed operations infeasible.

For a variety of reasons the administrative provisions under Maximum Protection are expected to affect placer mining, small exploration, and small underground operations relatively more than would the performance standard provisions. The administrative provisions likely to cause the greatest effects are the following:

- Eliminating Notice-level operations for disturbances of less than 5 acres during a calendar year.
- Validity exams and economic feasibility analyses.
- Bonding requirements.
- The requirement that all existing operations comply with the provisions of this alternative (no "grandfather" provision).

BLANK

PAGE

Table 3-28. Alternative 3 (Proposed Action) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$106,000	$94,600	$129,000	$115,000	$59,300	$52,700	$27,500	$24,400	$75,400	$67,000	670	780
Arizona	44,900	34,900	36,500	28,400	18,500	14,400	11,000	8,540	21,700	16,900	290	220
California	87,400	72,800	128,000	107,000	68,900	57,400	41,900	34,900	75,400	62,900	920	770
Colorado	36,000	28,000	51,800	40,300	25,600	19,900	14,700	11,400	30,400	23,700	320	250
Idaho	49,800	44,300	62,500	55,500	31,800	28,200	18,600	16,600	37,800	33,400	610	540
Montana	41,300	32,100	55,500	43,200	747,000	20,500	16,400	12,700	33,800	26,300	370	290
Nevada	1,050,000	819,000	1,630,000	1,270,000	10,800	581,000	420,000	326,000	817,000	635,000	9,670	7,520
New Mexico	23,000	1,710	28,800	22,400	475	8,400	4,950	3,850	14,900	11,600	200	150
Oregon	1,910	49,200	1,190	1,060	18,800	425	855	765	950	850	10	9
Utah	63,300	14,700	44,300	34,400	11,300	14,600	9,980	7,770	23,100	18,000	320	250
Washington	17,400	4,460	18,900	15,900	1,710	9,520	7,220	6,090	12,600	10,600	120	100
Wyoming	4,980	5,510	3,330	2,980	1,800	1,530	855	765	2,380	2,130	30	30
Study-Area Total	$1,530,000	$1,210,000	$2,770,000	$2,200,000	$1,250,000	$994,000	$690,000	$548,000	$1,430,000	$1,140,000	19,200	15,240

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	($11,800)	($23,600)	($14,400)	($28,800)	($6,950)	($13,200)	($3,050)	($6,100)	($8,380)	($16,800)	(100)	(190)
Arizona	(5,000)	(15,000)	(4,060)	(12,200)	(2,050)	(6,150)	(1,220)	(3,660)	(2,410)	(7,230)	(30)	(100)
California	(9,710)	(24,300)	(14,200)	(35,600)	(7,550)	(19,100)	(4,650)	(11,600)	(8,380)	(21,000)	(100)	(260)
Colorado	(4,000)	(12,000)	(5,760)	(17,300)	(2,540)	(8,520)	(1,630)	(4,890)	(3,380)	(10,100)	(40)	(110)
Idaho	(5,530)	(11,100)	(6,940)	(13,900)	(3,530)	(7,060)	(2,070)	(4,140)	(4,180)	(8,360)	(70)	(140)
Montana	(4,590)	(13,800)	(6,170)	(18,500)	(2,930)	(8,790)	(1,820)	(5,460)	(3,760)	(11,300)	(40)	(120)
Nevada	(117,000)	(351,000)	(181,000)	(543,000)	(83,000)	(249,000)	(46,600)	(140,000)	(90,800)	(272,000)	(1,070)	(3,220)
New Mexico	(2,560)	(7,670)	(3,200)	(9,600)	(1,200)	(3,600)	(550)	(1,650)	(1,660)	(4,980)	(22)	(70)
Oregon	(101)	(302)	(63)	(188)	(25)	(75)	(45)	(135)	(50)	(150)	(1)	(2)
Utah	(7,040)	(21,100)	(4,920)	(14,800)	(2,090)	(6,270)	(1,110)	(3,330)	(2,570)	(7,710)	(40)	(110)
Washington	(917)	(3,670)	(995)	(3,990)	(595)	(2,380)	(380)	(1,520)	(665)	(2,660)	(7)	(30)
Wyoming	(262)	(787)	(175)	(525)	(90)	(270)	(45)	(135)	(125)	(375)	(2)	(5)
Study-Area Total	($169,000)	($484,000)	($305,000)	($877,000)	($138,000)	($396,000)	($75,800)	($218,000)	($157,000)	($453,000)	(2,110)	(6,070)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 50, except figures under 25. Source: IMPLAN Input-Output Modeling System.

The requirement to submit Plans of Operations regardless of potential acreage disturbed would affect most current small operations and all potential future operations that would otherwise have filed Notices under the existing regulations. These operations would be required to give more information, would be subject to more agency and public involvement, and would have to obtain agency approval before proceeding.

The requirement to conduct validity exams and economic feasibility analyses would affect all types of proposed operations except for exploration. This requirement would cause permitting delays and impose more analysis costs on both BLM and applicants. Bonding for unplanned events could also add substantial costs to some operations.

The "no grandfathering" provision would potentially have a large effect on many existing operations, mainly large metal mines. But the provision also allows for some exceptions for technical, environmental, safety, or economic reasons.

Also, the provision for Native American concurrence on Plan approval would affect all operations in cases where Native American traditional cultural values may be impacted.

The performance standards are expected to affect open pit mining and large exploration and large underground operations relatively more than would the administrative provisions. Although all performance standards are expected to affect operations, probably the greatest relative impact would be due to mandatory pit backfilling, water treatment provisions, and unsuitability criteria for certain mineral deposits.

Overall, under Alternative 4, the value of mine production of locatable minerals would decrease by from 46% to 69%, or $773 million to $1.2 billion across the study area. This level of decreased production would cause the following decreases:

- 9,700 to 14,600 jobs.
- $1.4 billion to $2.1 billion in total industry output
- $633 million to $955 million in total personal income (of which $349 million to $526 million is employee compensation).
- $723 million to $1.1 billion in value-added.

Table 3-39 shows the regional economic impacts by state and for the study area overall. For the study areas's total current value-added as measured by gross state product (GSP), this $723 million to $1.1 billion would represent a 10% to 14% decrease in GSP-related value in the metals and nonmetallic sectors.

All states would face decreased levels of activity on public lands, but to differing degrees depending on the mining method most prevalent in the state. Open pit mining would be more significantly affected than other types of mining. And states where open pit mining dominates on public lands would be relatively more affected. Of the total value of production from federal land, gold makes up 85% ($1.4 billion in gold production out of $1.7 billion for all minerals). And most of this gold production comes from open pit mining–the mining method most heavily affected by Maximum Protection. Most of this gold production, and open pit mining in general, is concentrated in just a few states.

Although most states have open pit mines, six states are likely to be most affected: Arizona, Colorado, Montana, Nevada, New Mexico, and Utah. In these states, production levels are estimated to decline by 50% to 75% from current levels. This decline represents the following loss in production value:

- $24.9 million to $37.4 million for Arizona.
- $20 million to $30 million for Colorado.
- $22.9 million to 34.4 million for Montana.
- $585 million to $877 million for Nevada.
- $12.8 million to $19.2 million for New Mexico.
- $35.2 million to $52.8 million for Utah.

The other states would be affected to lesser but varying degrees, by percentage change in value of production. In Alaska, most current production from BLM-administered lands comes from placer mining, which would decrease from current levels by 20% to 30%, or $23.6 million to $35.5 million. Production in California would decrease by 30% to 50% ($29.1 million to $48.5 million) due to a greater level of industrial mineral production relative to open pit production.

Industrial minerals production mainly uses strip mining methods, which would be subject to fewer restrictions than open pit methods. In Idaho, production would decrease by 25% to 40% overall, or by $13.8 million to $22.1 million. This amount reflects Idaho's mix of open pit and underground operations. Idaho tends to have a greater proportion of underground mines than the study area overall, and underground mines would be less affected than would open pit mines.

In Oregon and Wyoming most production involves industrial minerals. The estimated decrease in production for both states is 10% to 20% ($201,000 to $402,000 in Oregon and $524,000 to $1 million in Wyoming). In Washington production would decrease by 25% to 40% ($4.6 million to $7.3 million), given its mix of open pit metals operations and industrial mineral mines, which are more apt to use strip methods. Impacts in Table 3-39 reflect these differences.

Nevada, with its concentration of open pit gold mines, would face the greatest reduction in activity, a $585 million to $877 million decrease in production value. This decrease would create a $904 to $1.4 billion decrease in industry output and a loss of 5,370 to 8,060 jobs.

Across the study area, an overall decline of 10% to 75% in mineral production, depending on mining methods, would result from a variety of responses by the mining industry. Because of the "no grandfather" provision, many current operations might close down if they could not comply with the provisions of the Maximum Protection Alternative. But this provision does allow some exceptions for technical, environmental, safety, or economic reasons.

Some potential future operations would then be considered subeconomic and would not be developed. Future operations might have shorter mine lives. Or current operations that might expand under these new regulations might close sooner, holding constant other factors (e.g. technology, commodity prices, and political and economic conditions for mining in other countries).

The level of decrease in activity assumed under Alternative 4 would also likely cause decreased exploration in the study area for two reasons. First, exploration would be directly affected by the provisions of this alternative. All exploration projects would be required to file Plans of Operations and meet the provisions of the performance standards. These provisions could substantially increase exploration costs and thus decrease activity. Second, and possibly more important, the expected decrease in mining due to more restrictive performance and design standards would decrease the desirability of exploring for new or expanded deposits in the study area. Consequently, exploration on non-BLM-administered lands or foreign countries might become relatively more attractive.

Rural communities where locatable minerals are now being mined could also be substantially affected. Because existing operations would not be grandfathered, many of these operations could incur significant costs to comply with this alternative's provisions. Where operations could absorb these costs, mines lives might be shortened if portions of the ore deposit become uneconomic and higher graded deposits could not be found. Other operations could not absorb these costs and would shut down completely.

The extent to which communities would be affected would depend on a variety of factors: the level of local current activity; the community's dependence on mining subject to 3809 regulations; whether existing operations could meet the more restrictive requirements; and the size of the community, its isolation, and other factors. In small, isolated communities with a high degree of specialization in mining, the impact of a mine shutting down would be significant. Larger communities with a lesser degree of specialization in mining would be less affected. Nevada communities would have the greatest potential for significant impact given the high degree of specialization in metal mining–the type of mining likely to be affected most.

The extent to which commodity prices might be affected under Maximum Protection is unknown. Gold production is likely to be most heavily affected because most gold production on public lands comes from open pit mines. An estimated 40% of all domestic gold production comes from federal land (including land managed by agencies other than BLM), with a estimated value of $1.44 billion (see Table 3-31). A 50% to 75% decrease of this 40% means that total domestic production would decrease by 20% to 30%. A 20% to 30% decline in domestic production would translate to a 3% to 4.5% decrease in worldwide production at current worldwide production levels. Given recent projections for the rate of growth in production worldwide (1.3% to 3% per year), a 3% to 4.5% decline falls just above this range of variability.

A supply decline of this magnitude could create a short-term increase in the price of gold, holding other factors affecting price constant (such as changes in production technology and worldwide demand) until more production could come online to offset the decline in U.S. production.

Prices for other commodities are not likely to be affected for a two reasons: (1) A lower proportion of total domestic production comes from BLM-administered land for most of these minerals, and (2) these minerals use a wide variety of mining methods and rely less on open pit methods for extraction.

Alternative 5

After full implementation of Alternative 5, mineral activity in the study area could decrease up to 10% from current levels, assuming current trends in mining continue for the foreseeable future. The degree of impact would vary by state, depending mainly on the dominant types of mining and/or commodities mined in each state. In some states, there may be no impact. For example, in states with relatively more metal mining and where larger operations are concentrated (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Utah), the estimated decrease in value of production would be 0 to -5%. For those states with relatively more small operations (Alaska, California, Washington, and Wyoming), the impacts would be greater, an estimated decrease of -5% to -10%.

For small mining operations (i.e. less than 5 acres), the provisions of Alternative 5 that would create the greatest impact are the administrative requirements designed to increase resource protection. Specifically, all Notice-level mining would be required to submit Plans of Operations. Exploration disturbing less than 5 acres in special status areas would also have to file Plans of Operations

These new requirements for small operations would increase the workload, time, and cost of obtaining approval for mining and exploration. But the degree to which these factors (workload, time, and cost) would increase would depend on the type of operation and the reason a Plan would be required instead of a Notice.

In addition, new filing requirements for Plans of Operations, such as more data, would increase costs for data collection and possibly take more time than currently is the case.

New requirements for bonding constitute another administrative area that would increase costs for smaller Notice-level operations. Although new bonding requirements would affect all types of operations, those most affected would be small operations (e.g. exploration, placer, small open pit, and underground). These impacts would mainly be due to bonding amounts and the requirement that the bond instrument be filed with BLM.

Eliminating corporate guarantees to satisfy bond requirements would affect some larger operations. Current corporate guarantees would not be affected, but corporate guarantees would not be allowed in the future. The cost of bonding would thus increase for operations that use corporate guarantees. This impact would be concentrated in Nevada, where corporate

BLANK

PAGE

Table 3-39. Alternative 4 (Maximum Protection) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$94,600	$82,700	$115,000	$101,000	$52,700	$46,100	$24,400	$21,400	$67,000	$58,700	780	680
Arizona0	24,900	12,500	20,300	10,200	10,300	5,130	6,100	3,050	12,100	6,030	160	80
California	68,000	48,500	99,700	71,200	53,600	38,300	32,600	23,300	58,700	41,900	710	510
Colorado0	20,000	9,990	28,800	14,400	14,200	7,100	8,150	4,080	16,900	8,450	180	90
Idaho	41,500	33,200	52,000	41,600	26,500	21,200	15,500	12,400	31,400	25,100	510	410
Montana0	22,900	11,500	30,900	15,400	14,700	7,330	9,100	4,550	18,800	9,400	210	100
Nevada0	585,000	292,000	904,000	452,000	415,000	207,000	233,000	117,000	454,000	227,000	5,370	2,690
New Mexico	12,800	6,390	16,000	8,000	6,000	3,000	2,750	1,380	8,300	4,150	110	60
Oregon	1,810	1,610	1,130	1,000	450	400	810	720	900	800	9	8
Utah	35,200	17,600	24,600	12,300	10,500	5,230	5,550	2,780	12,900	6,430	180	90
Washington	13,800	11,000	14,900	11,900	8,930	7,140	5,700	4,560	9,980	7,980	100	80
Wyoming	4,720	4,200	3,150	2,800	1,620	1,440	810	720	2,250	2,000	30	24
Study-Area Total	$925,000	$532,000	$1,680,000	$963,000	$758,000	$435,000	$417,000	$240,000	$866,000	$497,000	11,610	6,670

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	($23,600)	($35,500)	($28,800)	($43,100)	($13,200)	($19,800)	($6,100)	($9,150)	($16,800)	($25,100)	(190)	(290)
Arizona	(24,900)	(37,400)	(20,300)	(30,500)	(10,300)	(15,400)	(6,100)	(9,150)	(12,100)	(18,100)	(160)	(240)
California	(29,100)	(48,500)	(42,700)	(71,200)	(23,000)	(38,300)	(14,000)	(23,300)	(25,100)	(41,900)	(310)	(510)
Colorado	(20,000)	(30,000)	(28,800)	(43,200)	(14,200)	(21,300)	(8,150)	(12,200)	(16,900)	(25,400)	(180)	(260)
Idaho	(13,800)	(22,100)	(17,400)	(27,800)	(8,830)	(14,100)	(5,180)	(8,280)	(10,500)	(16,700)	(170)	(270)
Montana	(22,900)	(34,400)	(30,900)	(46,300)	(14,700)	(22,000)	(9,100)	(13,700)	(18,800)	(28,200)	(210)	(310)
Nevada	(585,000)	(877,000)	(904,000)	(1,360,000)	(415,000)	(622,000)	(233,000)	(350,000)	(454,000)	(681,000)	(5,370)	(8,060)
New Mexico	(12,800)	(19,200)	(16,000)	(24,000)	(6,000)	(9,000)	(2,750)	(4,130)	(8,300)	(12,500)	(110)	(170)
Oregon	(201)	(402)	(125)	(250)	(50)	(100)	(90)	(180)	(100)	(200)	(1)	(2)
Utah	(35,200)	(52,800)	(24,600)	(36,900)	(10,500)	(15,700)	(5,550)	(8,330)	(12,900)	(19,300)	(180)	(270)
Washington	(4,590)	(7,340)	(4,975)	(7,960)	(2,980)	(4,760)	(1,900)	(3,040)	(3,330)	(5,320)	(30)	(50)
Wyoming	(524)	(1,050)	(350)	(700)	(180)	(360)	(90)	(180)	(250)	(500)	(3)	(6)
Study-Area Total	($773,000)	($1,170,000)	($1,400,00)	($2,110,000)	($633,000)	($955,000)	($349,000)	($526,000)	($723,000)	($1,090,000)	(9,700)	(14,600)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 50, except figures under 25. Source: IMPLAN Input-Output Modeling System.

guarantees are now allowed and are used by large mining companies.

The value of mine production originating from public lands under Alternative 5 is estimated to decrease by up to 10%, or $12 million to $100 million across the study area. This level of decreased production would cause the following decreases:

- 150 to 1,260 jobs to the region.
- $21.5 million to $182 million in total industry output.
- $9.7 million to $82 million in total personal income (of which $5.4 million to $45.2 million is employee compensation).
- $11.1 million to $93.7 million in value-added.

Table 3-40 shows the regional economic impacts by state and for the study area overall. For the study areas's total current value-added as measured by gross state product (GSP), this $11.1 million to $93.7 million would represent a 0.1% to 1.2% decrease in GSP-related value in the metals and nonmetallic sectors.

Most states would see decreased levels of mineral production value on public lands, ranging from $100 thousand to $200 thousand in Oregon to $0 to $58.5 million in Nevada. Nevada's share of the loss would be 58% of the loss for the study area as a whole. But Nevada's existing regulations already incorporate most of the provisions of Alternative 5, so the estimated 5% decline in that state's production might be overstated. On the other hand, the impacts in Nevada are based only on the portion of production coming from public lands. To the extent that the affected portion from public lands might affect a larger portion of production from non-BLM lands, the impacts to Nevada may be understated.

A variety of responses by the mining industry would result in a decline of up to10% from current levels overall in mineral production across the study area:

- Some potential future operations would be considered subeconomic and therefore would not be developed.
- Future operations might have shorter mine lives.
- Current operations that might expand under these new regulations might close sooner than they otherwise would, holding constant such factors as technology, commodity prices, and political and economic conditions for mining in other countries.
- Because of more restrictions, less exploration would decrease opportunities for future development, so some deposits would not even be found.

This analysis is based on BLM's best estimates of potential overall reductions in the level of production of mineral commodities and estimates of increased costs borne by firms. But aggregate levels of output might not change, given more efficient mining and reclamation techniques or other changes in market conditions. Total quantity produced could remain unchanged. Alternatively, the regulatory cost burden imposed by the proposed regulations could be overwhelmed by other market forces–such as commodity prices–that might play a relatively more important role in miners' production decisions.

Further, BLM would not implement the regulations in a static environment. Both miners and BLM would probably become more efficient at complying with the regulations over time. In the long run the regulations might even create incentives for firms to seek new lower cost approaches to mining and reclamation. This is a reasonable assumption given the inclination most firms have to constantly seek least-cost technology and business practices. This assumption implies that the costs of the regulations could decline over time.

Commodity prices would not be likely to change in response to a decline of 0% to 10% in production because the prices for most mineral commodities are determined on world markets and individual production decisions do not affect prices. For commodities whose prices are not determined on world markets (such as some of industrial minerals), prices are assumed to be established on local markets, and changes in public land production are assumed not to affect these prices.

Rural communities might or might not be affected, depending on a variety of factors: the current local level of activity; the degree of dependency or "specialization" a community may have in mining subject to 3809 regulations; and the size of the community, its isolation, and other factors. Small rural communities in most states would lose only a small number of jobs and output relative to overall employment and output levels. And some or all of this decrease might be due to forgone future mining rather than current operations shutting down, or closing earlier than originally planned due to a reduction in economic reserves. In other words, Alternative 5 might not affect current mining in these communities, but new operations in the future might not be developed.

In Nevada, impacts to rural communities might be greater than in other states due to the greater estimated decrease in activity (up to 540 jobs and $90.4 million in total industry output). But the impact to any particular community in the state would depend on whether it results from existing mines closing prematurely or potential future operations not being developed. Any impacts at the community level would not likely occur in the short term while the proposed regulations are being implemented because mines with existing permits would not be affected unless they submit amendments to their Plans of Operations. But Nevada's existing regulations already incorporate most of the provisions of Alternative 5, so the estimated 5% decline in production might be overstated.

Table 3-40. Alternative 5 (NRC Recommendations) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$112,000	$106,000	$137,000	$129,000	$62,600	$59,300	$29,000	$27,500	$79,600	$75,400	920	870
Arizona	49,900	47,400	40,800	38,600	20,500	19,500	12,200	11,600	24,100	22,900	320	300
California	92,200	87,400	135,000	128,000	72,700	68,900	44,200	41,900	79,600	75,400	970	920
Colorado	40,000	38,000	57,600	54,700	28,400	27,000	16,300	15,500	33,800	32,100	350	330
Idaho	55,300	49,800	69,400	62,500	35,300	31,800	20,700	18,600	41,800	37,600	680	610
Montana	45,900	43,600	61,700	58,600	29,300	27,800	18,200	17,300	37,600	35,700	410	390
Nevada	1,170,000	1,110,000	1,810,000	1,720,000	830,000	788,000	466,000	443,000	908,000	862,000	10,700	10,200
New Mexico	25,600	24,300	32,000	30,400	12,000	11,400	5,500	5,230	16,600	15,800	220	210
Oregon	1,910	1,810	1,190	1,130	475	450	855	810	950	900	10	9
Utah	70,300	66,800	49,200	46,700	20,900	19,900	11,100	10,500	25,700	24,400	360	340
Washington	17,400	16,500	18,900	17,900	11,300	10,700	7,220	6,840	12,600	12,000	120	120
Wyoming	4,980	4,720	3,330	3,150	1,710	1,620	855	810	2,380	2,250	30	30
Study-Area Total	$1,690,000	$1,600,000	$3,060,000	$2,990,000	$1,380,000	$1,310,000	$761,000	$721,000	$1,580,000	$1,490,000	21,160	20,050

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	($5,910)	($11,800)	($7,190)	($14,400)	($3,300)	($6,590)	($1,530)	($3,050)	(4,190)	($8,380)	(50)	(100)
Arizona	0	(2,490)	0	(2,030)	0	(1,030)	0	(610)	0	(1,210)	0	(16)
California	(4,850)	(9,710)	(7,120)	(14,200)	(3,830)	(7,650)	(2,330)	(4,650)	(4,190)	(8,380)	(50)	(100)
Colorado	0	(2,000)	0	(2,880)	0	(1,420)	0	(815)	0	(1,690)	0	(18)
Idaho	0	(5,530)	0	(6,940)	0	(3,530)	0	(2,070)	0	(4,180)	0	(70)
Montana	0	(2,300)	0	(3,090)	0	(1,470)	0	(910)	0	(1,880)	0	(21)
Nevada	0	(58,500)	0	(90,400)	0	(41,500)	0	(23,300)	0	(45,400)	0	(540)
New Mexico	0	(1,280)	0	(1,600)	0	(600)	0	(275)	0	(830)	0	(11)
Oregon	(101)	(201)	(63)	(125)	(25)	(50)	(45)	(90)	(50)	(100)	(1)	(1)
Utah	0	(3,520)	0	(2,460)	0	(1,050)	0	(555)	0	(1,290)	0	(18)
Washington	(917)	(1,840)	(995)	(1,990)	(595)	(1,190)	(380)	(760)	(665)	(1,330)	(7)	(13)
Wyoming	(262)	(524)	(175)	(350)	(90)	(180)	(45)	(90)	(125)	(250)	(2)	(3)
Study-Area Total	($12,000)	($99,700)	($21,500)	($182,000)	($9,730)	($82,000)	($5,360)	($45,200)	($11,100)	($93,700)	(150)	(1,260)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 50, except figures under 25. Source: IMPLAN Input-Output Modeling System.

297

BLANK PAGE

Chapter 4

Consultation and Coordination, Public Participation, and Preparers

Consultation and Coordination

The importance of federal-state consultation and coordination was established at the beginning of this effort to review and revise the 43 CFR 3809 regulations. In his January 6, 1997, memorandum directing the BLM to start the rulemaking process, the Secretary of the Interior directed that "Coordination with state regulatory programs should be carefully addressed, to ensure that Federal Land Policy and Management Act's purpose of avoiding unnecessary or undue degradation is achieved, while minimizing duplication and promoting cooperation among regulators."

We coordinated with state governments, state regulatory agencies, American Indian tribal governments, and other federal agencies, including the Environmental Protection Agency, Fish and Wildlife Service, and the Bureau of Indian Affairs, in developing the proposed regulations and preparing the draft and final EISs. No formally designated cooperating or joint lead agencies helped prepare this EIS.

We began working closely with the governors and state agencies of the "Mining Law" states before issuing the Notice of Intent to Prepare an EIS and continued this consultation through the issuance of the Notice of Availability for the final EIS. The importance of this consultation and coordination was reiterated in the 1998 Interior Appropriations Act, which directed the Secretary of the Interior to certify that he had consulted with the affected states.

On April 8, 1997, March 3, 1998, and again on September 22, 1998, the BLM/Department of the Interior (DOI) team drafting the regulations participated in meetings hosted by the Western Governors' Association. These meetings with representatives of western state governments and agencies focused on concerns about the concepts and provisions in the working drafts of the proposed regulations. We also solicited written comment on the drafts of the proposed regulations from the states. The Western Governors' Association was a conduit to facilitate much of the consultation with the states.

Both DOI and BLM officials contacted affected state governors and state regulatory agencies. During the public comment period on the proposed regulations and draft EIS, the BLM/DOI regulation team again met with the western states government and government agency representatives to discuss concerns. This meeting was hosted by the Western Governors' Association in Denver, Colorado, on January 11, 2000.

To obtain input from American Indians, we consulted and coordinated with the Bureau of Indian Affairs, the Native American Indian Congress, and tribal governments. Key points of consultation and coordination included a presentation to the Indian Minerals Steering Committee by Robert Anderson, BLM Deputy Assistant Director for Minerals, Realty, and Resource Protection. We also distributed preliminary draft regulations to potentially affected tribal governments and held an information briefing/public meeting on the Fort Belknap Indian Reservation in Montana.

While developing the proposed regulations and preparing the draft EIS, we consulted informally with the Fish and Wildlife Service and National Marine Fisheries Service. In revising the proposed regulations and preparing the final EIS, we prepared a biological assessment of the proposed rules. Before authorizing surface disturbance actions under the 3809 regulations, site- specific consultation may be required under Section 7 of the Endangered Species Act.

Before authorizing surface disturbance, BLM would consider the effects of the site-specific proposal on cultural resources that are listed or eligible for listing on the National Register of Historic Places through the consultation process in Section 106 of the National Historic Preservation Act of 1966.

Public Participation

In January 1997, the Secretary of the Interior directed BLM to continue with the regulation review process promised in 1981 and begun in 1991. Because of the time that had passed since the 1991 effort, we started a new public participation process in early 1997 and requested comments from its field offices on the existing regulations and suggestions for improvement. We encouraged public participation by the following actions:

- Prescoping outreach to special interest groups and government officials.
- Scoping for the EIS, including a formal 81-day comment period and 19 public meetings in 12 cities.
- Placing the proposed regulations, draft EIS, and related documents on BLM's Internet web site.
- Two public comment periods for the EIS and proposed 43 CFR 3809 regulations, including 29 public hearings in 16 cities.

Information gathered during the prescoping outreach and public scoping process was analyzed and used to determine the issues that were addressed and the alternatives presented in detail in the draft EIS. The draft EIS was subject to further public review and comment during the public comment period. Following the second public comment period, the proposed regulations were revised and the final EIS prepared. The final EIS considers and responds to all substantive comments and incorporate changes to the final EIS in response to the comments received during the review period.

We have actively sought public involvement throughout the process to ensure that the process is open and that BLM has considered information from all interested parties, including the following:

- Other federal agencies
- State and local governments.
- American Indian tribal governments.
- The scientific community.
- Professional, conservation, and trade organizations.
- Public land users and stakeholders.
- Citizens at large.

One of the efforts to increase information to the public was to post the proposed regulations, draft EIS, other documents, announcements, and schedules on BLM's Internet web site. The web site was updated regularly to give users the latest information on working drafts of the regulations, schedules, and other information on the project. As of July 31, 2000, the Internet web site had had more than 25,000 visits.

Outreach

In March 1997, we issued a press release to announce the revision effort and a task force of agency staff with experience in the program to coordinate public involvement, develop regulation options, and oversee the preparing of an EIS on the effects of changes to the regulations. From March through May, we conducted briefings on the revision process for conservation and industry groups; congressional offices; and local, state, and federal government agencies. Although this outreach occurred before and not as part of formal scoping, we considered the views expressed in developing the proposed rules and draft EIS.

Beginning in April 1997, we sent information packages to all of our offices for distribution to the public. These information packages contained the following:

- The Secretary of the Interior's January 1997 letter beginning the regulation review.
- A briefing summary of the development of the current regulations and related policies.
- The proposed regulation and EIS schedules.
- An explanation of the proposed process for reviewing and revising the regulations and developing the EIS.

Table 4-1. Informational and Scoping Meetings for the Draft EIS

Date (1997)	Location	Approximate Attendance
May 13	Spokane, WA	40
May 13	Denver, CO	125
May 15	Fairbanks, AK	65
May 15	Phoenix, AZ	142
May 20	Casper, WY	22
May 20	Reno, NV	233
May 20	Socorro, NM	15
May 22	Washington, DC	80
May 28	San Francisco, CA	68
May 28	Helena, MT	132
May 28	Salt Lake City, UT	70
June 16	Eugene, OR	40

We mailed these information packages to interested or affected stakeholders, passed them out at our offices, and distributed them at meetings with interest groups. In addition, we gave interested parties summaries of the scoping comments from the aborted 1991 reform effort.

Scoping

We conducted extensive public scoping for the draft EIS. On April 4, 1997, a *Federal Register* notice announced BLM's intent to prepare an EIS, requested scoping comments, and gave the schedule for public scoping meetings. We also issued national and local news releases announcing the scoping process. To collect a wide range of comments, we held public scoping or informational meetings at the locations shown in Table 4-1. In addition to oral comments at public meetings, we received 1,832 comment letters (including email messages) on revising the 3809 regulations.

The deadline for providing scoping comments was ultimately extended through June 23, 1997, but the record remained open until the proposed regulations were being finalized in the fall of 1998. Comments received after June 23, 1997 were reviewed by the regulation and EIS teams.

To establish a framework for scoping , we selected eight topics that had previously been listed as program issues:

- The definition of *unnecessary or undue degradation*.
- The development of specific performance standards for mining and reclamation.
- The 5-acre disturbance threshold between Notice- and Plan-level operations.
- Coordination between state and federal regulators.
- The type and adequacy of penalties for violating regulations.
- The review time frames for Notices and Plans of Operations.
- The definition of *casual use*.
- Requirements for reclamation bonding.

We also invited participants to comment on any other issues of concern in the surface management program.

A comment analysis team was formed to review the comments. In summarizing the scoping comments the team grouped them into comments on the following subjects:

- Eight issue topics originally selected by BLM.
- New issues.
- Suggestions for preparing the EIS.
- Scoping process.

In addition, comments by BLM field office staff were grouped as such. The results of the comment analysis were given to the two teams working on the regulations and the draft EIS. In

September 1997, a scoping report summarizing the comments received through June 23, 1997 (BLM 1997a) was distributed to all who submitted comments or expressed an interest in the rulemaking or EIS.

We based the first working draft of the proposed regulations on comments from outreach and scoping, reviews by BLM field offices, and guidance from the Department of the Interior. In February 1998 we requested reviews and comments on the first working draft of the proposed regulations from federal, state, local, and tribal officials. In addition, we released the draft for public review. In response to comments, we prepared a second draft and posted it on the Internet on August 11, 1998. Chapter 1 discusses issues, concerns, and alternatives discussed through scoping.

Public Comment Period

The proposed regulations and draft EIS were subject to public review and comment during two public comment periods. The first period ran from February 9, 1999 to May 10, 1999. Starting on March 23, 2000, we held 29 public hearings in 16 cities on the proposed regulations and draft EIS (see Table 4-2). In addition to the transcripts from the public hearings, we received more than 2,100 comment letters, including email. After the close of the first comment period, BLM released to the public the *43 CFR 3809 Surface Management Regulations Interim Content Analysis Report* (BLM 1999c) summarizing public comments.

On September 29, 1999, the National Research Council (NRC) released its report *Hardrock Mining on Federal Lands* (NCR 1999). This report discussed the Council's assessment of the adequacy of the existing regulatory framework for hardrock mining on federal lands. As directed by Congress, BLM opened an additional 120-day comment period on the proposed regulations and draft EIS to provide input based on the NRC findings and recommendations. We arranged to have the NRC report distributed to all persons and organizations that had expressed an interest in the rulemaking or EIS. In announcing the comment period in the Federal Register (October 26, 1999), we requested more public input on the proposed regulations in relationship to the NRC recommendations. This comment period ran from October 26, 1999 to January 24, 2000.

Table 4-2. Public Hearings on the Proposed Regulations and Draft EIS

Date (1999)	Location	No. of Hearings
March 23	Reno, NV	2
March 25	Elko, NV	2
March 30	Fairbanks, AK	2
March 30	Phoenix, AZ	2
March 30	Lakewood, CO	2
March 31	Casper, WY	2
March 31	Socorro, NM	1
April 7	Salt Lake City, UT	2
April 14	Washington, DC	1
April 14	Helena, MT	2
April 20	San Francisco, CA	2
April 20	Spokane, WA	2
April 21	Ontario, CA	2
April 22	Eugene, OR	2
April 22	Sacramento, CA	2
April 27	Boise, ID	1

We received more than 400 comment letters during the second public comment period. Following the second comment period, we revised the proposed regulations and prepared the final EIS. The final EIS considered and responded to all substantive comments received during both comment periods and incorporated changes to the final EIS in response to those comments.

Distribution

The draft EIS, along with the proposed rules (see Appendix B of the draft EIS), was released for public review and comment during two public comment periods. One copy of the draft EIS was mailed to each person and organization that provided comments during scoping or expressed an interest in the rulemaking or EIS. We are similarly distributing the final EIS to all persons and organizations expressing an interest in this rulemaking and to organizations that may not have submitted comments: congressional offices; federal, state, and local agencies; tribal governments; and conservation and trade organizations. Appendix B lists recipients of the final EIS. Copies of the draft and final EIS and the regulations have also been posted on BLM's Internet web site.

Other Actions

Once the final EIS was published, the *Federal Register* announced its availability. No sooner than 30 days after publication of the final EIS, the Secretary of the Interior will issue a record of decision. At the same time, on the basis of that record of decision, the final rules will be published in the *Federal Register*.

List of Preparers

The following people are responsible for the content and analysis in this final EIS. All are employees of the Bureau of Land Management.

Archer, Scott F.	Climate, Air Quality National Applied Resources Science Center, Denver, CO B.S., Chemistry and Environmental Science, Northern Arizona University -8 years, Senior Air Resource Specialist, BLM. -12 years, Air Resource Specialist, BLM Colorado State Office. -4 years, Research Scientist, U.S. Environmental Protection Agency-Environmental Monitoring Systems Lab.
Favinger, Wendy A.	Economic Conditions Montana State Office, Billings, MT B.A., Economics, University of Nevada, Reno M.A., Economics, University of Nevada, Reno -10 years experience conducting economic analysis for local and regional land use plans, mining Plans of Operations, and national programmatic regulatory actions.
Gordon, Christine C.	Wildlife Resources, Riparian-Wetland Resources, Wild Horses and Burros, Livestock Grazing Headquarters Office, Washington, DC B.S., Wildlife Management, Colorado State University M.S., Wildlife Biology, South Dakota State University -8 years BLM wildlife biologist.
Haight, Scott S.	Assistant Team Lead; Purpose and Need for Action, Proposed Action and Alternatives Lewistown Field Office, Lewistown, MT B.S., Geology, Rocky Mountain College, MT -15 years in the BLM surface management program processing Notices and Plans of Operations.
Kretsinger, Carl F.	Aquatic Resources, Riparian-Wetland Resources Northern Field Office, Fairbanks, Alaska B.S., Fisheries, Humboldt State University, CA -15 years experience as a fisheries biologist with the U.S. Fish and Wildlife Service, USDA Forest Service, and BLM in Oregon, Nevada, Idaho, California, and Alaska. -During past 11 years has been dealing specifically with placer mining in Alaska for BLM.
Lyle, John C.	Cultural Resources, Paleontological Resources, Cave Resources, American Indian Resources Burley Field Office, Burley, ID B.A., Anthropology, University of Wyoming

	M.A., Anthropology, University of Kansas -Planning and Environmental Coordination Archeologist for BLM Wyoming 1980-1982. -Worked on following EIS: Southwest Wyoming Coal, Southcentral Wyoming Coal, Wycoal Gasification, Energy Transportation Systems Incorporated Coal Slurry Pipeline.
McGinty, Herbert K.	Editing National Training Center, Phoenix, Arizona B.A., History, Duke University, NC M.A., Geography, Clark University, MA -24 years as writer-editor for BLM; edited 20 EISs.
McNutt, Paul J.	Team Lead; Consultation, Coordination, Public Participation, and Preparers Nevada State Office, Reno, NV B.S., Environmental Science, Utah State University M.S., Economics, Utah State University -22 years working on mineral- related issues. - Served as Program Manager of U.S. Bureau of Mines Mineral Land Assessment Program. -Worked on the Coal Programmatic EIS and numerous project-specific EIS.
Netcher, Daniel R.	Mineral Exploration and Development, Hazardous Materials and Waste Management Ely Field Office, Ely, NV B.S., Geology, University of Oregon -15 years working for BLM in minerals and hazardous materials. -Experience with several mineral types in Idaho, Utah, and Nevada. -Serves as Team Leader for Land and Minerals. -Served as team leader on several major EIS for mining. -Certified Mineral Examiner. -Completed requirements for a post graduate certificate in Hazardous Waste Management from Wayne State University.
Rieger, Nick	Soils, Vegetation Headquarter Office, Washington, DC B.S., Range Land Management, University of Arizona M.S., Natural Resources Science, University of Arizona -20 years as a BLM soil scientist, environmental protection specialist, and physical scientist. Spent most of the past 18 years administering the 43 CFR 3809 surface protection regulations in Nevada, which involved project management of many environmental assessments and EIS for major mine development projects in the Carlin Trend.
Strasfogel, Andrew L.	Washington Office Coordination Headquarters Office, Washington, DC B.A., Geology, Harvard College, MA -Evaluated mining properties in Railroad mining district, NV, 1967. -Geological field work and hardrock mineral exploration experience in

	Europe, western U.S., and Pacific region, 1966-1972. -Staff Geologist, International Paper Company, 1973-75. -Headquarters coordinator for 1985 Supplemental Federal Coal Management Program EIS. -Conducted onsite evaluations of hardrock mineral operations and regulatory issues on tribal lands. -Served 1 year with Department of Energy, Nuclear Fuel Cycle Production and Development Division. -Wrote secretarial issue documents for a variety of energy and minerals issues requiring high-level decision by the Department of the Interior.
Summers, Paul	Water Resources National Applied Resources Science Center, Denver, CO B.S., Geology, Utah State University -10 years experience in BLM's minerals program. -20 years experience conducting ground water investigations throughout the western United States. -Worked on environmental problems at open pit and underground mines. -Reviewed or helped prepare several mining and other EISs.
Trent, Joan	Recreation, Visual Resources, Social Conditions Montana State Office, Billings, MT B.A., Psychology, Miami University (Ohio) M.S., Environmental Science, Miami University (Ohio) -Served as a sociologist for 20 years with BLM and 2 years with the National Park Service. -Prepared social analysis for regional coal analyses and resource management plans covering oil and gas and hardrock mining and for more than 20 EIS and environmental assessments, including such programmatic EIS as Range Reform'94, Off-Highway Vehicles, and Oil and Gas.

We wish to thank BLM's Arizona State Office, Office of External Affairs, and BLM's National Training Center for their help in preparing this EIS. Judy McDonald of the National Training Center prepared the maps and illustrations, Beth Perault of the Arizona State Office designed and laid out the document, and Dorothea Boothe of the Arizona State Office arranged for and coordinated the document's printing and distribution.

Contributors

Aardahl, Jeff	Senior Specialist, T & E Species Program, Washington Office
Arvizo, Buddy	Senior Healthy Rangelands Specialist, Washington Office
Borchard, Steve	Watershed Specialist, Washington Office
Crespin, Bruce	Program Analyst, New Mexico State Office, Santa Fe
Cribley, Bud	Senior Wild Horse and Burro Specialist, Washington Office
Dalness, Bill	Geologist, New Mexico State Office, Santa Fe
Drew, Roy	Geologist, Colorado State Office, Denver
Elmore, Wayne	Riparian Manager, Riparian Service Team, Prineville, OR
Fisk, Bob	Mining Engineer, Alaska State Office, Anchorage
Geehan, Patrick	Chief of Physical Sciences, Oregon State Office, Portland
Goodbar, James R.	Outdoor Recreation Planner, Carlsbad Field Office, NM
Grabowski, Stephen J.	Anadromous Fish Coordinator, Washington Office (WO-230)
Gruber, Jim	Geologist, Montana State Office, Billings
Hamilton, Jim	Mining Engineer, California State Office, Sacramento
Jauhola, Christine	Group Manager, Washington Office (WO-230)
Kalvels, John	Mining Engineer, Oregon State Office, Portland
Keill, Donald D.	Senior Mining Engineer, Northern Field Office, Fairbanks, AK
Kershaw, Byard	Geologist, Arizona State Office, Phoenix
Kolkman, Gene A.	District Manager, Ely Field Office, Ely, NV
Lawton, Eric	Wildlife Biologist, Washington Office
Leonard, Steve	Range Ecologist, Riparian Service Team, Prineville, OR
Maley, Terry	Geologist, Idaho State Office, Boise
McCluskey, Cal	Senior Wildlife Specialist, Washington Office (detached to Boise)

McCoy, Ramone	Wildlife Biologist, Phillips Resource Area, Malta, MT
Piper, Steve	Natural Resource Economist, Bureau of Reclamation, Technical Services Center, Denver, CO
Prichard, Don	Inland Fisheries Biologist, National Applied Resources Science Center, Denver, CO
Reed, Reg	Geologist, Nevada State Office, Reno
Rich, Terrel	Wildlife Biologist, Washington Office (detached to Boise)
Simon, Benjamin	Economist, Department of the Interior, Washington, D.C.
Smith, Craig	Geologist, Nevada State Office, Reno
Snyder, Terry	Geologist, Utah State Office, Salt Lake City
Steward, Larry	Geologist, Nevada State Office, Reno
Wadleigh, Dale	Mining Engineer, Wyoming State Office, Cheyenne

Regulation Team

The following people currently form the Regulation Team responsible for developing the proposed rules:

Anderson, Robert M.	Deputy Assistant Director, Minerals, Reality, and Resource Protection, Team Lead, Headquarters Office, Washington, DC
Boddington, Celia	Group Manager, Public Affairs Headquarters Office, Washington, DC
Boyd, Patrick	Regulatory Analyst Headquarters Office, Washington, DC
Bozorth, Tim	Senior Hydrologist Montana State Office, Billings, MT
Finfer, Lawrence A.	Assistant Director, Communication Headquarters Office, Washington, DC
Haight, Scott S.	Mineral Resource Specialist Lewistown Field Office, Lewistown, MT
Hankins, Helen	District Manager Elko Field Office, Elko, NV
Leshendok, Tom	Deputy State Director for Mineral Resources Nevada State Office, Reno, NV
McNutt, Paul J.	Physical Scientist Nevada State Office, Reno, NV
Rabinoff, Alan	Deputy State Director for Minerals and Lands Wyoming State Office, Cheyenne, WY
Schwartz, Michael H.	Group Manager, Regulatory Affairs Headquarters Office, Washington, DC
Yudson, Joel M.	Attorney, Office of the Solicitor Department of the Interior, Washington, DC

APPENDIXES

CONTENTS

Appendix A—Existing 3809 Regulations A-2
Appendix B—Recipients of the Final EIS A-19
Appendix C—Other Applicable Requirements A-38
Appendix D—Mining Regulatory Programs in the Western United States A-51
Appendix E—Changes in Mineral Activities A-123
Appendix F—Plant and Animal Lists A-223
Appendix G—Economics A-245

310

APPENDIX A
EXISTING 3809 REGULATIONS

PART 3800--MINING CLAIMS UNDER THE GENERAL MINING LAWS

Authority: 16 U.S.C. 351; 16 U.S.C. 460y-4; 30 U.S.C. 22; 31 U.S.C. 9701; 43 U.S.C. 154; 43 U.S.C. 299; 43 U.S.C. 1201; 43 U.S.C. 1740; 30 U.S.C. 28k.

* * * * *

Subpart 3809 -- Surface Management

Source: 45 FR 78909, Nov. 26, 1980, unless otherwise noted.

Note: The information collection requirements contained in this subpart have been approved by the Office of Management and Budget under 44 U.S.C. 3507 and assigned clearance number 1004 - 0104. This information is needed to permit the authorized officer to determine if a plan of operation is needed to protect the public lands and their resources and to determine if the plan of operations, if one is required, is adequate. The obligation to respond is required to obtain a benefit.

(See 48 FR 8816, Mar. 2, 1983.)

General

§ 3809.0 - 1 Purpose.

The purpose of this subpart is to establish procedures to prevent unnecessary or undue degradation of Federal lands which may result from operations authorized by the mining laws.

§ 3809.0 - 2 Objectives.

The objectives of this regulation are to:

(a) Provide for mineral entry, exploration, location, operations, and purchase pursuant to the mining laws in a manner that will not unduly hinder such activities but will assure that these activities are conducted in a manner that will prevent unnecessary or undue degradation and provide protection of nonmineral resources of the Federal lands;

(b) Provide for reclamation of disturbed areas; and

(c) Coordinate, to the greatest extent possible, with appropriate State agencies, procedures

311

for prevention of unnecessary or undue degradation with respect to mineral operations.

§ 3809.0 - 3 Authority.

(a) Section 2319 of the Revised Statutes (30 U.S.C. 22 et seq.) provides that exploration, location and purchase of valuable mineral deposits, under the mining laws, on Federal lands shall be ``under regulations prescribed by law," and section 2478 of the Revised Statutes, as amended (43 U.S.C. 1201), provides that those regulations shall be issued by the Secretary.

(b) Sections 302, 303, 601, and 603 of the Federal and Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.) require the Secretary to take any action, by regulation or otherwise, to prevent unnecessary or undue degradation of the Federal lands, provide for enforcement of those regulations, and direct the Secretary to manage the California Desert Conservation Area under reasonable regulations which will protect the scenic, scientific, and environmental values against undue impairment, and to assure against pollution of streams and waters.

(c) The Act of July 23, 1955 (30 U.S.C. 612), provides that rights under mining claims located after July 23, 1955, shall prior to issuance of patent therefor, be subject to the right of the United States to manage and dispose of the vegetative surface resources and to manage other surface resources. The Act also provides that ``Any mining claim hereafter located under the mining laws of the United States shall not be used, prior to issuance to patent therefor, for any purposes other than prospecting, mining or processing operations and uses reasonably incident thereto."

(d) Section 9 of the Wild and Scenic Rivers Act (16 U.S.C. 1280) provides that regulations issued shall, among other things, provide safeguards against pollution of the rivers involved and unnecessary impairment of the scenery within the area designated for potential addition to, or an actual component of the national wild and scenic rivers system.

(e) The Act of October 21, 1970 (16 U.S.C. 460y et seq.), as amended by Section 602 of the Federal Land Policy and Management Act of 1976 (16 U.S.C. 460y - 8), established the King Range Conservation Area in California. The Secretary is required under these Acts to manage activities in this conservation area under the General Mining Law of 1872 in such a manner as to protect the scenic, scientific, and environmental values against undue impairment, and ensure against pollution of streams and waters.

[45 FR 78909, Nov, 26, 1980, as amended at 59 FR 44856, Aug. 30, 1994]

§ 3809.0 - 5 Definitions.

As used in this subpart, the term:

(a) Authorized officer means any employee of the Bureau of Land Management to whom authority has been delegated to perform the duties described in this subpart.

318

(b) Casual Use means activities ordinarily resulting in only negligible disturbance of the Federal lands and resources. For example, activities are generally considered casual use if they do not involve the use of mechanized earth moving equipment or explosives or do not involve the use of motorized vehicles in areas designated as closed to off-road vehicles as defined in subpart 8340 of this title.

(c) Federal lands means lands subject to the mining laws including, but not limited to, the certain public lands defined in section 103 of the Federal Land Policy and Management Act of 1976. Federal lands does not include lands in the National Park System, National Forest System, and the National Wildlife Refuge System, nor does it include acquired lands, Stockraising Homestead lands or lands where only the mineral interest is reserved to the United States or lands under Wilderness Review and administered by the Bureau of Land Management (these lands are subject to the 43 CFR part 3802 regulations).

(d) Mining claim means any unpatented mining claim, millsite, or tunnel site located under the mining laws and those patented mining claims and millsites located in the California Desert Conservation Area which have been patented subsequent to the enactment of the Federal Land Policy and Management Act of October 21, 1976.

(e) Mining laws means the Lode Law of July 26, 1866, as amended (14 Stat. 251); the Placer Law of July 9, 1870, as amended (16 Stat. 217); and the Mining Law of May 10, 1872, as amended (17 Stat. 91); and all laws supplementing and amending those laws, including among others the Building Stone Act of August 4, 1892, as amended (27 Stat. 348); and the Saline Placer Act of January 31, 1901 (31 Stat. 745).

(f) Operations means all functions, work, facilities, and activities in connection with prospecting, discovery and assessment work, development, extraction, and processing of mineral deposits locatable under the mining laws and all other uses reasonably incident thereto, whether on a mining claim or not, including but not limited to the construction of roads, transmission lines, pipelines, and other means of access for support facilities across Federal lands subject to these regulations.

(g) Operator means a person conducting or proposing to conduct operations.

(h) Person means any citizen of the United States or person who has declared the intention to become such and includes any individual, partnership, corporation, association, or other legal entity.

(i) Project area means a single tract of land upon which an operator is, or will be, conducting operations. It may include one mining claim or a group of mining claims under one ownership on which operations are or will be conducted, as well as Federal lands on which an operator is exploring or prospecting prior to locating a mining claim.

(j) Reclamation means taking such reasonable measures as will prevent unnecessary or

313

undue degradation of the Federal lands, including reshaping land disturbed by operations to an appropriate contour and, where necessary, revegetating disturbed areas so as to provide a diverse vegetative cover. Reclamation may not be required where the retention of a stable highwall or other mine workings is needed to preserve evidence of mineralization.

(k) Unnecessary or undue degradation means surface disturbance greater than what would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character and taking into consideration the effects of operations on other resources and land uses, including those resources and uses outside the area of operations. Failure to initiate and complete reasonable mitigation measures, including reclamation of disturbed areas or creation of a nuisance may constitute unnecessary or undue degradation. Failure to comply with applicable environmental protection statutes and regulations thereunder will constitute unnecessary or undue degradation. Where specific statutory authority requires the attainment of a stated level of protection or reclamation, such as in the California Desert Conservation Area, Wild and Scenic Rivers, areas designated as part of the National Wilderness System administered by the Bureau of Land Management and other such areas, that level of protection shall be met.

(l) King Range Conservation Area means the area designated pursuant to the Act of October 21, 1970 (16 U.S.C. 460y et seq.), as amended by Section 602 of the Federal Land Policy and Management Act of 1976 (16 U.S.C. 460y - 8).

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980, as amended at 48 FR 8816, Mar. 2, 1983; 59 FR 44856, Aug. 30, 1994]

§ 3809.0 - 6 Policy.

Consistent with section 2 of the Mining and Mineral Policy Act of 1970 and section 102(a) (7), (8), and (12) of the Federal Land Policy and Management Act, it is the policy of the Department of the Interior to encourage the development of Federal mineral resources and reclamation of disturbed lands. Under the mining laws a person has a statutory right, consistent with Departmental regulations, to go upon the open (unappropriated and unreserved) Federal lands for the purpose of mineral prospecting, exploration, development, extraction and other uses reasonably incident thereto. This statutory right carries with it the responsibility to assure that operations include adequate and responsible measures to prevent unnecessary or undue degradation of the Federal lands and to provide for reasonable reclamation.

§ 3809.1 Operations.

§ 3809.1 - 1 Reclamation.

All operations, whether casual, under a notice, or by a plan of operations, shall be reclaimed as required in this title.

§ 3809.1 - 2 Casual use: Negligible disturbance.

No notification to or approval by the authorized officer is required for casual use operations. However, casual use operations are subject to monitoring by the authorized officer to ensure that unnecessary or undue degradation of Federal lands will not occur.

§ 3809.1 - 3 Notice: Disturbance of 5 acres or less.

(a) All operators on project areas whose operations, including access across Federal lands to the project area, cause a cumulative surface disturbance of 5 acres or less during any calendar year shall notify the authorized officer in the District office of the Bureau of Land Management having jurisdiction over the land in which the claim(s) or project area is located. Prior to conducting additional operations under a subsequent notice covering substantially the same ground, the operator shall have completed reclamation of operations which were conducted under any previous notice. Notification of such activities, by the operator, shall be made at least 15 calendar days before commencing operations under this subpart by a written notice or letter.

(b) Approval of a notice, by the authorized officer, is not required. Consultation with the authorized officer may be required under paragraph (c)(3) of this section when the construction of access routes are involved. Notices properly filed under this section constitute authorization under part 8340 of this title (Off-Road Vehicles).

(c) The notice or letter shall include:

(1) Name and mailing address of the mining claimant and operator, if other than the claimant. Any change of operator or in the mailing address of the mining claimant or operator shall be reported promptly to the authorized officer;

(2) When applicable, the name of the mining claim(s), and serial number(s) assigned to the mining claim(s) recorded pursuant to subpart 3833 of this title on which disturbance will likely take place as a result of the operations;

(3) A statement describing the activities proposed and their location in sufficient detail to locate the activities on the ground, and giving the approximate date when operations will start. The statement shall include a description and location of access routes to be constructed and the type of equipment to be used in their construction. Access routes shall be planned for only the minimum width needed for operations and shall follow natural contours, where practicable, to minimize cut and fill. When the construction of access routes involves slopes which require cuts on the inside edge in excess of 3 feet, the operator may be required to consult with the authorized officer concerning the most appropriate location of the access route prior to commencing operations;

(4) A statement that reclamation of all areas disturbed will be completed to the standard described in § 3809.1 - 3(d) of this title and that reasonable measures will be taken to prevent

unnecessary or undue degradation of the Federal lands during operations.

(d) The following standards govern activities conducted under a notice:

(1) Access routes shall be planned for only the minimum width needed for operations and shall follow natural contours, where practicable to minimize cut and fill.

(2) All tailings, dumps, deleterious materials or substances, and other waste produced by the operations shall be disposed of so as to prevent unnecessary or undue degradation and in accordance with applicable Federal and State Laws.

(3) At the earliest feasible time, the operator shall reclaim the area disturbed, except to the extent necessary to preserve evidence of mineralization, by taking reasonable measures to prevent or control on-site and off-site damage of the Federal lands.

(4) Reclamation shall include, but shall not be limited to:

(i) Saving of topsoil for final application after reshaping of disturbed areas have been completed;

(ii) Measures to control erosion, landslides, and water runoff;

(iii) Measures to isolate, remove, or control toxic materials;

(iv) Reshaping the area disturbed, application of the topsoil, and revegetation of disturbed areas, where reasonably practicable; and

(v) Rehabilitation of fisheries and wildlife habitat.

(5) When reclamation of the disturbed area has been completed, except to the extent necessary to preserve evidence of mineralization, the authorized officer shall be notified so that an inspection of the area can be made.

(e) Operations conducted pursuant to this subpart are subject to monitoring by the authorized officer to ensure that operators are conducting operations in a manner which will not cause unnecessary or undue degradation.

(f) Failure of the operator to prevent undue or unnecessary degradation or to complete reclamation to the standards described in this subpart may cause the operator to be subject to a notice of noncompliance as described in § 3809.3 - 2 of this title.

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980, as amended at 48 FR 8816, Mar. 2, 1983]

§ 3809.1 - 4 Plan of operations: When required.

An approved plan of operations is required prior to commencing:

(a) Operations which exceed the disturbance level (5 acres) described in § 3809.1 - 3 of this title.

(b) Any operation, except casual use, in the following designated areas:

(1) Lands in the California Desert Conservation Area designated as controlled or limited use areas by the California Desert Conservation Area plan;

(2) Areas designated for potential addition to, or an actual component of the national wild and scenic rivers system,

(3) Designated Areas of Critical Environmental Concern;

(4) Areas designated as part of the National Wilderness Preservation System and administered by the Bureau of Land Management;

(5) Areas designated as closed to off-road vehicle use as defined in subpart 8340 of this title.

(6) The area designated as the King Range Conservation Area pursuant to 16 U.S.C. 460y et seq., as amended by section 602 of the Federal Land Policy and Management Act of 1976.

(c) Plans properly filed and approved under this section constitute authorization under part 8340 of this title (Off-Road Vehicles).

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980, as amended at 48 FR 8816, Mar. 2, 1983; 59 FR 44856, Aug. 30, 1994]

§ 3809.1 - 5 Filing and contents of plan of operations.

(a) A plan of operations must be filed in the District Office of the Bureau of Land Management having jurisdiction over the Federal lands in which the claim(s) or project area is located.

(b) No special form is required for filing a plan.

(c) The plan shall include:

(1) The name and mailing address of the operator (and claimant if not the operator). Any change of operator or change in the mailing address shall be promptly reported to the authorized officer;

(2) A map, preferably a topographic map, or sketch showing existing and/or proposed routes of access, aircraft landing areas, or other means of access, and size of each area where surface disturbance will occur;

(3) When applicable, the name of the mining claim(s) and mining claim serial numbers assigned to the mining claim(s) recorded pursuant to subpart 3833 of this title.

(4) Information sufficient to describe or identify the type of operations proposed, how they will be conducted and the period during which the proposed activity will take place;

(5) Measures to be taken to prevent unnecessary or undue degradation and measures to reclaim disturbed areas resulting from the proposed operations, including the standards listed in § 3809.1 - 3(d) of this title. Where an operator advises the authorized officer that he/she does not have the necessary technical resources to develop such measures the authorized officer will assist the operator in developing such measures. If an operator submits reclamation measures, the authorized officer will ensure that the operator's plan is sufficient to prevent unnecessary or undue degradation. All reclamation measures developed by the operator, or by the authorized officer in conjunction with the operator, shall become a part of the plan of operations.

(6) Measures to be taken during extended periods of nonoperation to maintain the area in a safe and clean manner and to reclaim the land to avoid erosion and other adverse impacts. If not filed at the time of plan submittal, this information shall be filed with the authorized officer whenever the operator anticipates a period of nonoperation.

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980]

§ 3809.1 - 6 Plan approval.

(a) A proposed plan of operations shall be submitted to the authorized officer, who shall promptly acknowledge receipt thereof to the operator. The authorized officer shall, within 30 days of such receipt, analyze the proposal in the context of the requirement to prevent unnecessary or undue degradation and provide for reasonable reclamation, and shall notify the operator:

(1) That the plan is approved; or

(2) Of any changes in or additions to the plan necessary to meet the requirements of these regulations; or

(3) That the plan is being reviewed, but that a specified amount of time, not to exceed an additional 60 days, is necessary to complete the review, setting forth the circumstances which justify additional time for review. However, days during which the area of operations is inaccessible for inspection shall not be counted when computing the 60 day period; or

(4) That the plan cannot be approved until 30 days after a final environmental statement has been prepared and filed with the Environmental Protection Agency; or

(5) That the plan cannot be approved until the authorized officer has complied with section 106 of the National Historic Preservation Act or section 7 of the Endangered Species Act.

(b) The authorized officer shall consult with the appropriate official of the bureau or agency having surface management responsibilities where such responsibility is not exercised by the Bureau of Land Management. Prior to plan approval the authorized officer shall obtain the concurrence of such appropriate official to the terms and conditions that may be needed to prevent unnecessary or undue degradation.

(c) The authorized officer shall undertake an appropriate level of cultural resource inventory of the area to be disturbed. The inventory shall be completed within the time allowed by these regulations for approval of the plan (30 days). The operator is not required to do the inventory but may hire an archaeologist approved by the Bureau of Land Management in order to complete the inventory more expeditiously. The responsibility for and cost of salvage of cultural resources discovered during the inventory shall be the Federal Government's. The responsibility of avoiding adverse impacts on those cultural resources discovered during the inventory shall be the operator's.

(d) Pending final approval of the plan, the authorized officer shall approve any operations that may be necessary for timely compliance with requirements of Federal and State laws, subject to any terms and conditions that may be needed to prevent unnecessary or undue degradation.

(e) In the event of a change of operators involving an approved plan of operations, the new operator shall satisfy the requirements of § 3809.1 - 9 of this title as it relates to bonding.

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980]

§ 3809.1 - 7 Modification of plan.

(a) At any time during operations under an approved plan, the operator on his/her own initiative may modify the plan or the authorized officer may request the operator to do so.

(b) A significant modification of an approved plan must be reviewed and approved by the authorized officer in the same manner as the initial plan.

(c)(1) If, when requested to do so by the authorized officer, the operator does not furnish a proposed modification within a reasonable time, usually 30 days, the authorized officer may recommend to the State Director that the operator be required to submit a proposed modification of the plan. The recommendation of the authorized officer shall be accompanied by a statement setting forth the facts and the reasons for the recommendations.

319

(2) In acting upon such recommendations the State Director shall determine, within 30 days, whether:

(i) All reasonable measures were taken by the authorized officer at the time the plan was approved to ensure that the proposed operations would not cause unnecessary or undue degradation of the Federal land;

(ii) The disturbance from the operations of the plan as approved or from unforeseen circumstances is or may become of such significance that modification of the plan is essential in order to prevent unnecessary or undue degradation; and

(iii) The disturbance can be minimized using reasonable means.

(3) Once the matter has been sent to the State Director, an operator is not required to submit a proposed modification of an approved plan until a determination is made by the State Director. Where the State Director determines that a plan shall be modified, the operator shall timely submit a modified plan to the authorized officer for review and approval.

(4) Operations may continue in accordance with the approved plan until a modified plan is approved, unless the State Director determines that the operations are causing unnecessary or undue degradation to the land. The State Director shall advise the operator of those reasonable measures needed to avoid such degradation and the operator shall immediately take all necessary steps to implement those measures within a reasonable period established by the State Director.

§ 3809.1 - 8 Existing operations.

[following section was reinstated by court's May 1998 ruling]

(a) Persons conducting operations on the effective date of these regulations, who would be required to submit a notice under § 3809.1 - 3 or a plan of operations under § 3809.1 - 4 of this title may continue operations but shall, within:

(1) 30 days submit a notice with required information outlined in § 3809.1 - 3 of this title for operations where 5 acres or less will be disturbed during a calendar year; or

(2) 120 days submit a plan in those areas identified in § 3809.1 - 4 of this title. Upon a showing of good cause, the authorized officer may grant an extension of time, not to exceed an additional 180 days, to submit a plan.

(b) Operations may continue according to the submitted plan during its review. If the authorized officer determines that operations are causing unnecessary or undue degradation of the Federal lands involved, the authorized officer shall advise the operator of those reasonable measures needed to avoid such degradation, and the operator shall take all necessary steps to implement those measures within a reasonable time recommended by the authorized officer.

320

During the period of an appeal, if any, operations may continue without change, subject to other applicable Federal and State laws.

(c) Upon approval of a plan by the authorized officer, operations shall be conducted in accordance with the approval plan.

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980]

§ 3809.1 - 9 Bonding requirements.
[following section was reinstated by court's May 1998 ruling]

(a) No bond shall be required for operations that constitute casual use (§ 3809.1 - 2) or that are conducted under a notice (§ 3809.1 - 3 of this title).

(b) Any operator who conducts operations under an approved plan of operations as described in § 3809.1 - 5 of this title may, at the discretion of the authorized officer, be required to furnish a bond in an amount specified by the authorized officer. The authorized officer may determine not to require a bond in circumstances where operations would cause only minimal disturbance to the land. In determining the amount of the bond, the authorized officer shall consider the estimated cost of reasonable stabilization and reclamation of areas disturbed. In lieu of the submission of a separate bond, the authorized officer may accept evidence of an existing bond pursuant to State law or regulations for the same area covered by the plan of operations, upon a determination that the coverage would be equivalent to that provided in this section.

(c) In lieu of a bond, the operator may deposit and maintain in a Federal depository account of the United States Treasury, as directed by the authorized officer, cash in an amount equal to the required dollar amount of the bond or negotiable securities of the United States having a market value at the time of deposit of not less than the required dollar amount of the bond.

(d) In place of the individual bond on each separate operation, a blanket bond covering statewide or nationwide operations may be furnished at the option of the operator, if the terms and conditions, as determined by the authorized officer, are sufficient to comply with these regulations.

(e) In the event that an approved plan is modified in accordance with § 3809.1 - 7 of this title, the authorized officer shall review the initial bond for adequacy and, if necessary, adjust the amount of the bond to conform to the plan as modified.

(f) When all or any portion of the reclamation has been completed in accordance with the approved plan, the operator may notify the authorized officer that such reclamation has occurred and that she/he seeks a reduction in bond or Bureau approval of the adequacy of the reclamation, or both. Upon any such notification, the authorized officer shall promptly inspect the reclaimed area with the operator. The authorized officer shall then notify the operator, in writing, whether the reclamation is acceptable. When the authorized officer has accepted as completed any portion of the reclamation, the authorized officer shall authorize that the bond be reduced proportionally to cover the remaining reclamation to be accomplished.

(g) When a mining claim is patented, the authorized officer shall release the operator from that portion of the performance bond which applies to operations within the boundaries of the patented land. The authorized officer shall release the operator from the remainder of the performance bond, including the portion covering approved means of access outside the boundaries of the mining claim, when the operator has completed acceptable reclamation. However, existing access to patented mining claims, if across Federal lands shall continue to be regulated under the approved plan. The provisions of this subsection do not apply to patents. issued on mining claims within the boundaries of the California Desert Conservation Area (see § 3809.6 of this title).

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980]

§ 3809.2 Prevention of unnecessary or undue degradation.

§ 3809.2 - 1 Environmental assessment.

(a) When an operator files a plan of operations or a significant modification which encompasses land not previously covered by an approved plan, the authorized officer shall make an environmental assessment or a supplement thereto to identify the impacts of the proposed operations on the lands and to determine whether an environmental impact statement is required.

(b) In conjunction with the operator, the authorized officer shall use the environmental assessment to determine the adequacy of mitigating measures and reclamation procedures included in the plan to insure the prevention of unnecessary or undue degradation of the land. If an operator advises the authorized officer that he/she is unable to prepare mitigating measures, the authorized officer, in conjunction with the operator, shall use the environmental assessment as a basis for assisting the operator in developing such measures.

(c) If, as a result of the environmental assessment, the authorized officer determines that there is substantial public interest in the plan, the authorized officer shall notify the operator, in writing, that an additional period of time, not to exceed the additional 60 days provided for approval of a plan in § 3809.1 - 6 of this title, is required to consider public comments on the environmental assessment.

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980, as amended at 48 FR 8816, Mar. 2, 1983]

§ 3809.2 - 2 Other requirements for environmental protection.

All operations, including casual use and operations under either a notice (§ 3809.1 - 3) or a plan of operations (§ 3809.1 - 4 of this title), shall be conducted to prevent unnecessary or undue degradation of the Federal lands and shall comply with all pertinent Federal and State laws, including but not limited to the following:

(a) Air quality. All operators shall comply with applicable Federal and State air quality standards, including the Clean Air Act (42 U.S.C. 1857 et seq.).

(b) Water quality. All operators shall comply with applicable Federal and State water quality standards, including the Federal Water Pollution Control Act, as amended (30 U.S.C. 1151 et seq.).

(c) Solid wastes. All operators shall comply with applicable Federal and State standards for the disposal and treatment of solid wastes, including regulations issued pursuant to the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.). All garbage, refuse or waste shall either be removed from the affected lands or disposed of or treated to minimize, so far as is practicable, its impact on the lands.

(d) Fisheries, wildlife and plant habitat. The operator shall take such action as may be needed to prevent adverse impacts to threatened or endangered species, and their habitat which may be affected by operations.

(e) Cultural and paleontological resources. (1) Operators shall not knowingly disturb, alter, injure, or destroy any scientifically important paleontological remains or any historical or archaeological site, structure, building or object on Federal lands.

(2) Operators shall immediately bring to the attention of the authorized officer any cultural and/or paleontological resources that might be altered or destroyed on Federal lands by his/her operations, and shall leave such discovery intact until told to proceed by the authorized officer. The authorized officer shall evaluate the discoveries brought to his/her attention, take action to protect or remove the resource, and allow operations to proceed within 10 working days after notification to the authorized officer of such discovery.

(3) The Federal Government shall have the responsibility and bear the cost of investigations and salvage of cultural and paleontology values discovered after a plan of operations has been approved, or where a plan is not involved.

(f) Protection of survey monuments. To the extent practicable, all operators shall protect all survey monuments, witness corners, reference monuments, bearing trees and line trees against unnecessary or undue destruction, obliteration or damage. If, in the course of operations, any monuments, corners, or accessories are destroyed, obliterated or damaged by such operations, the operator shall immediately report the matter to the authorized officer. The authorized officer shall prescribe, in writing, the requirements for the restoration or reestablishment of monuments, corners, bearing and line trees.

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980, as amended at 48 FR 8816, Mar. 2, 1983]

§ 3809.3 General provisions.

§ 3809.3 - 1 Applicability of State law.

(a) Nothing in this subpart shall be construed to effect a preemption of State laws and regulations relating to the conduct of operations or reclamation on Federal lands under the mining laws.
[[following section was reinstated by court's May 1998 ruling]

(b) After the publication date of these regulations the Director, Bureau of Land Management, shall conduct a review of State laws and regulations in effect or due to come into effect, relating to unnecessary or undue degradation of lands disturbed by exploration for, or mining of, minerals locatable under the mining laws.

(c) The Director may consult with appropriate representatives of each State to formulate and enter into agreements to provide for a joint Federal-State program for administration and enforcement. The purpose of such agreements is to prevent unnecessary or undue degradation of the Federal lands from operations which are conducted under the mining laws, to prevent unnecessary administrative delay and to avoid duplication of administration and enforcement of laws. Such agreements may, whenever possible, provide for State administration and enforcement of such programs.

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980]

§ 3809.3 - 2 Noncompliance.

(a) Failure of an operator to file a notice under § 3809.1 - 3 of this title or a plan of operations under § 3809.1 - 4 of this title will subject the operator, at the discretion of the authorized officer, to being served a notice of non-compliance or enjoined from the continuation of such operations by a court order until such time as a notice or plan is filed with the authorized officer. The operator shall also be responsible to reclaim operations conducted without an approved plan of operations or prior to the filing of a required notice.

(b) Failure to reclaim areas disturbed by operations under § 3809.1 - 3 of this title is a violation of these regulations.

(1) Where an operator is conducting operations covered by 3809.1 - 3 (notice) of this title and fails to comply with the provisions of that section or properly conduct reclamation according to standards set forth in 3809.1 - 3(d) of this title, a notice of noncompliance shall be served by delivery in person to the operator or his/her authorized agent, or by certified mail addressed to his/her address of record.

(2) Operators conducting operations under an approved plan of operations who fails to

follow the approved plan of operations may be subject to a notice of noncompliance. A notice of noncompliance shall be served in the same manner as described in § 3809.3 - 2(b)(1) of this section.

(c) All operators who conduct operations under a notice pursuant to § 3809.1 - 3 and a plan pursuant to § 3809.1 - 4 of this title on Federal lands without taking the actions specified in a notice of noncompliance within the time specified therein may be enjoined by an appropriate court order from continuing such operations and be liable for damages for such unlawful acts.

(d) A notice of noncompliance shall specify in what respects the operator is failing or has failed to comply with the requirements of applicable regulations, and shall specify the actions which are in violation of the regulations and the actions which shall be taken to correct the noncompliance and the time, not to exceed 30 days, within which corrective action shall be started.

[following section was reinstated by court's May 1998 ruling]

(e) Failure of an operator to take necessary actions on a notice of noncompliance, may constitute justification for requiring the submission of a plan of operations under § 3809.1 - 5 of this title, and mandatory bonding for subsequent operations which would otherwise be conducted pursuant to a notice under § 3809.1 - 3 of this title.

[45 FR 78909, Nov. 26, 1980; 45 FR 82934, Dec. 17, 1980]

§ 3809.3 - 3 Access.

(a) An operator is entitled to access to his operations consistent with provisions of the mining laws.

(b) Where a notice or a plan of operations is required, it shall specify the location of access routes for operations and other conditions necessary to prevent unnecessary or undue degradation. The authorized officer may require the operator to use existing roads to minimize the number of access routes, and, if practicable, to construct access roads within a designated transportation or utility corridor. When commercial hauling is involved and the use of an existing road is required, the authorized officer may require the operator to make appropriate arrangements for use and maintenance.

§ 3809.3 - 4 Fire prevention and control.

The operator shall comply with all applicable Federal and State fire laws and regulations, and shall take all reasonable measures to prevent and suppress fires in the area of operations.

§ 3809.3 - 5 Maintenance and public safety.

During all operations, the operator shall maintain his structures, equipment, and other facilities in a safe and orderly manner. Hazardous sites or conditions resulting from operations shall be marked by signs, fenced, or otherwise identified to alert the public in accordance with applicable Federal and State laws and regulations.

§ 3809.3 - 6 Inspection.

The authorized officer may periodically inspect operations to determine if the operator is complying with these regulations. The operator shall permit the authorized officer access for this purpose.

§ 3809.3 - 7 Periods of non-operation.

All operators shall maintain the site, structures and other facilities of the operations in a safe and clean condition during any non-operating periods. All operators may be required, after an extended period of non-operation for other than seasonal operations, to remove all structures, equipment and other facilities and reclaim the site of operations, unless he/she receives permission, in writing, from the authorized officer to do otherwise.

§ 3809.4 Appeals.

(a) Any operator adversely affected by a decision of the authorized officer made pursuant to the provisions of this subpart shall have a right of appeal to the State Director, and thereafter to the Board of Land Appeals, Office of Hearings and Appeals, pursuant to part 4 of this title, if the State Director's decision is adverse to the appellant.

(b) No appeal shall be considered unless it is filed, in writing, in the office of the authorized officer who made the decision from which an appeal is being taken, within 30 days after the date of receipt of the decision. A decision of the authorized officer from which an appeal is taken to the State Director shall be effective during the pendency of an appeal. A request for a stay may accompany the appeal.

(c) The appeal to the State Director shall contain:

(1) The name and mailing address of the appellant.

(2) When applicable, the name of the mining claim(s) and serial number(s) assigned to the mining claims recorded pursuant to subpart 3833 of this title which are subject to the appeal.

(3) A statement of the reasons for the appeal and any arguments the appellant wishes to present which would justify reversal or modification of the decision.

(d) The State Director shall promptly render a decision on the appeal. The decision shall be in writing and shall set forth the reasons for the decision. The decision shall be sent to the appellant by certified mail, return receipt requested.

(e) The decision of the State Director, when adverse to the appellant, may be appealed to the Board of Land Appeals, Office of Hearings and Appeals, pursuant to part 4 of this title.

(f) Any party, other than the operator, aggrieved by a decision of the authorized officer shall utilize the appeals procedures in part 4 of this title. The filing of such an appeal shall not stop the authorized officer's decision from being effective.

(g) Neither the decision of the authorized officer nor the State Director shall be construed as final agency action for the purpose of judicial review of that decision.

[45 FR 78909, Nov. 26, 1980, as amended at 48 FR 8816, Mar. 2, 1983]

§ 3809.5 Public availability of information.

(a) Information and data submitted and specifically identified by the operator as containing trade secrets or confidential or privileged commercial or financial information shall not be available for public examination. Other information and data submitted by the operator shall be available for examination by the public at the office of the authorized officer in accordance with the provisions of the Freedom of Information Act.

(b) The determination concerning specific information which may be withheld from public examination shall be made in accordance with the rules in 43 CFR part 2.

§ 3809.6 Special provisions relating to mining claims patented within the boundaries of the California Desert Conservation Area.

In accordance with section 601(f) of the Federal Land Policy and Management Act of October 21, 1976, all patents issued on mining claims located within the boundaries of the California Desert Conservation Area after the enactment of the Federal Land Policy and Management Act shall be subject to the regulations in this part, including the continuation of a plan of operations and of bonding with respect to the land covered by the patent.

APPENDIX B
RECIPIENTS OF THE FINAL EIS

AGENCIES AND ORGANIZATIONS

3 R Minerals
3 R Assoc Env Consultants
Absentee Shawnee Tribe of Oklahoma
ADEQ
AEG
AES Engineering
Afognak Native Corporation
AGRA Earth & Environment
Agua Caliente Band of Cahuilla Indians
Ahtna, Inc.
Ak-Chin Indian Community
Akhiok-Kaguyak,inc.
Akiachak, Limited
Akutan Corporation
Alabama and Coushatta Tribes
Alabama Quassarte Tribal Town
Alakanuk Native Corporation
Alamo Navajo Chapter
Alaska Miners Association, Inc.
Alaska Peninsula Corporation
Alaska State Governor's Office
Alaska State Legislature
Alaska Department of Natural Resources
Alaska Placer Development, Inc.
Alaska Remote Sensing & Catographic
Aleknagik Natives Ltd.
Aleut Corporation
Alliance for the Wild Rockies
Alta Gold
Alturas Rancheria Federal Reservation
Amax Gold Inc. - Sleeper Mine
American Assay Labs, Inc.
American Canoe Association
American Colloid Company
American Whitewater
American International Group
American Lands Access Assn Inc
American Land Alliance
American Land Conservancy
American Fisheries Society, Oregon Chapter
American Resource Corporation, Inc.
Amigos
Andalex
Anderson Resources Association Inc
Apache Tribe of Oklahoma
Apex Bulk Commodities
Apollo Gold
Applied Independent Technology
Applied Ecosystem Services, Inc.
Arapaho Tribe
Arco Alaska, Inc.
Arctic Slope Consulting Group
Arctic Village
Arctic Treks
Arizona Builders Alliance
Arizona Department of Commerce
Arizona Audubon Council
Arizona Mining Association
Arizona Department of Environmental Quality
Arizona Department of Mines/Mineral Resources
Arizona State Governor's Office
Arizona State Historic Preservation Office
Arizona Small Mine Operators Assn
Arizona Electric Power Cooperative, Inc.
Arizona Game & Fish Department
Arizona State Parks
Arctic Slope Regional Corporation
Arviq, Inc.
ASARCO Inc.
ASE Management - BHP Minerals, International
Askinuk Corporation
Aspen Exploration
Atmautluak, Limited
Atqasuk Corp.
Atxam Corporation
AUR Resources (USA) Inc.
Austin Powder Company
Avalon Development Corporation
Azachorok, Inc
Aztech Controls Corp
Baan-O-Yeel Kon Corporation
Bagdad Unified School District, AZ
Bagdad Fire Department, AZ
Bald Mountain Mine
Ballard Spahr Andrews & Ingersoll
Bamberg Associates
Barona Group of the Barona Reservation
Barretts Minerals, Inc.
Barrick Bullfrog Mine
Barrick Gold Exploration
Barrick Goldstrike Mines Inc
Barrick Gold Corporation
Battle Mountian Band Colony
Battle Mountain Gold
Bay View Inc.
Bean Ridge Corporation
Bear River Band of Rohnerville Rancheria
Bear Creek Council
Beartooth Alliance
Beaver Kwit'Chin Corporation
Becharof Corporation
Behre Dorbear
Belkofski Corporation
Bells Flats Natives, Inc.
Benton County Commission, OR
Bentonite Corporation
Bentonite Perform Minerals
Bering Straits Native Corporation
Berry Creek Rancheria of Maidu Indians
Bethel Native Corporation
Beveridge & Diamond
BHP Copper
BHP - DC Office
BHP Nevada Mining Company
BHP Copper Robinson
BHP Minerals
BHP Non-Ferrous & Industrial Minerals
Big Valley Rancheria
Big Pine Band of Owens Valley Paiute-Shoshone Indians
Big Lagoon Rancheria
Big Sandy Rancheria Of Mono Indians
Bjork, Lindley & Danielson, P.C.
Blackfeet Reservation
Blanchard Rock Shop
Blue Lake Business Council
BMOA/OIM
Boart Longyear Company
Bond Mining Trust
Breckenridge Minerals
Brevig Mission Native Corporation
Bridgeport Paiute Indian Colony
Bristol Bay Native Corporation
Brohm Mining Corporation
Brush Wellman, Inc.
BLM Resource Advisory Councils
Burns Paiute Tribe
Buttercup Mining Co
C.W. Rech & Company, Inc.
Cabazon Band of Mission Indians
Cable Mountain Mine
Cachil Dehe Band of Wintun Indian of the Colusa Ind.
Caddo Tribe of Oklahoma
Cahto Indian Tribe
Cahuilla Band of Indians
W M Calhoun Inc
California Department of Fish & Game
California Department Of Conservation
California Wilderness Coalition
California Coastal Commission
California Department of Transportation
California Senate Committee on Environmental Quality
California Department of Fish and Game
California State Governor's Office
California State Lands Commission
California Native American Tribes
California Mining Association
California Trade and Commerce Agency, Office of PermitAssistance
Calista Corporation
Campo Band of Mission Indians
Camtec Industrial Sales
Cone Geochemical Inc
Canoncito Navajo Colony
Canyon Resources Corporation
Cape Fox Corporation
Carlotta Copper Company

Appendix B: Recipients of the Final EIS

Carson Colony Community Council
Carson Forest Watch
Cascade Metals Inc
Casper Star-Tribune
Castle Mountain Mine
Cedarville Rancheria of Northern Paiute Indians
Celilo Village Portland Office
Center for Alternative Mining Development Policy
Center for Science in Public Participation
Chalkyitsik Native Corporation
Chaluka Corporation
Chefarnrmute, Inc.
Chehalis Business Council
Chehalis, Chinook, and Quinault
Chem Mining Consulting Ltd
Chemehuevi Indian Tribe
Chemical Lime Company
Chenega Corporation
Cherokee Nation Economic & Business Development
Chevak Company Corporation
Cheyenne-Arapaho Tribes
Cheyenne River Sioux Tribe
Chickaloon-Moose Native Assoc., Inc.
Chignik River Limited
Chignik Lagoon Native Corporation
Chilkoot Indian Association
Chino Mines Co
Chinuruk Inc.
Chippewa-Cree Tribe
Chitina Native Corporation
Choctaw Nation of Oklahoma
Choggiung Ltd
Chugach Natives Inc.
Chugach Alaska Corporation
Churchill County Commission, NV
Citizen Band of Potawatomi
Citizen's Coal Council
Citizens for the West
Citizens Advisors Committee Federal Lands
Citizens of Victor
City of Carlin, NV
City of Elko, NV
City of Globe, AZ
City of Safford, AZ
CLC
CLD Surveying
Clear Creek & Gilpin Metal Mining
Clean Sites
Clean Age Minerals
Climax Moly Company
Coast Indian Community
Coastal Chemicals, Inc.
Cochise Co., AZ
Cocopah Indian Tribe
Coeur Alaska Inc
Coeur D'Alene Tribal Council
Coeur D'Alene Mines Corporation
Coeur Rochester, Inc.
Cold Springs Rancheria of Mono Indians
Colorado Mining Association
Colorado State Governor's Office
Colorado Division of Minerals & Geology
Colorado Representative Rodrigue's Office
Colorado Indian Tribe
Colville Reservation
Comanche Tribe of Oklahoma
Cominco American
Compass Mining Inc
Condor Earth Technologies, Inc.
Confederated Salish and Kootenai Tribes
Confederated Tribe of Coos, Lower Umpqua and Siuslaw Indians
Confederated Tribes of the Umatilla
Consumers Health Freedom Coalition
Continental Minerals, Inc.
Continental Lime, Inc.
Control Industries, Inc.
Cook Inlet Region, Inc.
Cooksley Geophysics
Coquille Indian Tribe Community
Cordex Exploration Company
Corporon Hochn Svitavsky Eyler & Hill
Cortez Gold Mines
Cortina Indian Rancheria of Wintun Indians
Cotter Corporation
Council Native Corporation
County of San Bernardino, CA
Covelo Indian Community
Cow Creek Band of Umpqua Tribe of Indians
Coyote Valley Tribal Council
CR Minerals
CR Kendall
CRC, Company
Creek Nation of Oklahoma, Office of the Principal Chief
Creole Corp
Crosible Filtration, Inc.
Crow Creek Sioux Reservation
Crow Tribe
Crowell & Moring Llp
Crown Resources
Crusher Service Company
CSM
Cully Corporation
CURE
Cuyapaipe Band of Mission Indians
CWG
Cyprus Amax Minerals
Cyprus Bagdad Copper Corporation
Cyprus Climax Metals Co
Cyprus Sierrita Corporation
Cyprus Miami Mining
D.H. Blattner & Sons
D&D Tire, Inc.
Dakota Resource Council
Danzhit Hanlaii Corporation
Davis, Graham & Stubbs
Death Valley Timbi-Sha Shoshone Band
Dee Gold Mining Company
Defenders of Wildlife
Delaware Tribe of Western Oklahoma
Deloycheet, Inc.
Denton Rawhide Mine
Denver Mining Finance Co
Desert Gold Diggers
Desert Protective Council
Desert Survivors
Devils Lake Sioux Tribe A.K.A. Mni Wakan Oyate Tribe
Diamond Hill Mines
Dicaperl Minerals
Dickenson City Citizens Committee "Save Virginia's Baby"
Dickstein Shapiro Morin & Oshinsky Llp
Digmore Mine
Dineega Corporation
Dinyea Corporation
Diomede Native Corporation
Discovery Dynamics Inc
DOC/OMR
Dot Lake Native Corporation
Downey Brand Seymour & Rohwer LLP
Doyon, Ltd.
Dresslerville Colony
Duck Valley Reservation
Duckwater Shoshone Tribe
Dupont Specialty Chemicals
Dupont
E & S Mining
Earthjustice Legal Defense Fund
Earth Science Consulting Service, Inc.
Eastern Shawnee Tribe of Oklahoma
Eastern Arizona Counties Organization
Eastern Shoshone Tribe
Echo Bay McCoy Cove
Echo Bay Mines
Echo Bay Minerals Company
Ecology Center of Southern California
EEEE, Inc.
Ekwok Natives Ltd.
Eklund Drilling
Eklutna, Inc.
El Dorado Mines
Eldorado Gene's Music
Elem Indian Colony of Pomo Indians
Elim Native Corporation
Elk Valley Tolowa
Elko Band Colony
Elko Chamber of Commerce
Elko Daily Free Press
Ely Indian Colony
Emery County, UT
Emmonak Corporation
Enchem Technology, Inc.
Energy Lab, Inc.
Energy West Mining
English Bay Corporation
Entrix, Inc.
Environmental Chemistries, Inc.
Environmental Management Assocs
Environmental Protection Agency
Environmental Protection Agency, Office of Solid Waste
ERO Resources Corporation
ESA Consultants
Esmeralda County Board of

Appendix B: Recipients of the Final EIS

Commissioners, NV
Engaze Sand & Gravel
Eureka Development Company, Ltd.
Eureka County Commissioners, NV
Euro-Nevada Mining
Evans Environmental Consultants
Evansville, Inc.
Eyak Corporation
Fairbanks Industrial Development Corporation
Fairmile Gold Corporation
Fallon Colony
Far West Inc.
Federal Reservation Miwok
Federal Reservation
Federal Reservation Cahuilla Band of Indians
Federal Reservation Pomo
Federal Paiute Reservation
Federal Reservation Eastern Pomo
Federal Reservation Me-wuk
Federal Summit Fluids
Federal Reservation Rumsey Rancheria
Flagstaff City Council
Flandreau Santee Sioux Tribe
Fleischli Oil Company
Florida Canyon Mining, Inc.
Forest Hydrology Northwest
Fort Mcdermitt Paiute and Shoshone Tribe
Fort Belknap Tribes, Environmental Protection Agency
Fort Bidwell Indian Community Of Piaute Indians
Fort Belknap Indian Community Gros Ventre & Assiniboine Tribes
Fort Mcdowell Mohave-Apache Indian Community
Fort Mohave Tribal Council
Fort Mojave Reservation
Fort Peck Assiniboine & Sioux Tribes
Fort Sill Apache Tribe of Oklahoma
Fortymile Mining District
Franco-Nevada Mining Corporation, Inc.
Friends of The Rocky Mountain Front
Friends of Westwater
Friends of Pebble Pinto Creek
Gallagher & Kennedy
Gallatin Wildlife Association
Gana-A 'Yoo, Ltd.
Gen Minerals Corp
Genwal
Geo Spec Engineering & Consulting Service
Geodesy Resources Exploration Inc
George Mason University
Geotemps, Inc.
Getchell Gold Corporation
Gila River Pima-Maricopa Indian Community
Gildarstone Mining & Restoration Ventures
GIS Land Services
Givens, Funke & Work
Glamis Gold, Inc.
Glamis Imperial Corp
Glamis Marigold Mining Co
Glamis Rand Mining Co
Glenbrook Nickel
Globe-Miami Chamber of Commerce
Gochnour & Associates, Inc.
Gold Bar Mine
Gold Capital Corp
Gold Country Miners Prospectors Org
Gold Hill Mining Co
Gold Hill Town Meeting, Inc
Gold Prospectors Assn of America
Gold Prospectors Assn of Tucson
Gold Rush
Golden Sunlight Mines
Golden Eagle Group
Golder Associates
Golovin Native Corporation
Goshute Paiute Tribe
Goshute Reservation
Gough, Shanahan, Johnson & Waterman Attorneys at Law
Governor of Guam's Office
Governor of Northern Mariana Island's Office
Governor of American Samoa's Office
GPAA, Ozarks Chapter
Graham Chamber of Commerce, AZ
Graham Co. Board of Supervisors, AZ
Grande Ronde Tribal Council
Grassroots Environmental Effective Network
Graves & Assocs LTD
Great Basin Agriculture Inc
Great Basin Mine Watch
Great Plains Rain Forest
Greater Wyoming Valley Audubon Soc.
Greater Fairbanks Chamber of Commerce, AK
Greater Yellowstone Coalition
Green Network
Greenlee County, AZ
Greenville Rancheria of Maidu Indians
Grindstone Indian Rancheria of Wintun-Wailaki
GSL Electric
Guardians of the Rural Environment Inc.
Gust Rosenfeld
Gustin Corp
Gwitchyaa Zhee Corporation
Hadum Inc.
Hagler Bailly
Haida Corporation
Harding Lawson Associates
Harold Rummels Building
Harris Exploration Drill & Assocs
Hauntz & Assocs
Havasu Gold Seekers
Havasupai Tribe
Hayfork Mining District
Hecla Mining Company
Hee-Yea-Lindge Corporation
Heklet Association
Heritage Land Bank
High Country Citizens' Alliance
Hoh Indian Tribe
Homestake Mining Company
Hoopa Vally Tribe
Hopi Tribe
Hopland Band of Pomo Indians
Horizons West
Hornet Enterprise Inc
Hualapai Tribe
Huekel Corporation
Humboldt City Board of Commissioners, NV
Humboldt County Commission, NV
Huna Totem Corporation
Hungwitchin Corporation
Hycroft
Hydrometrics, Inc.
Idaho Conserve Lea
Idaho Department of Lands
Idaho Bureau of Minerals
Idaho Farm Bureau Federation
Idaho Gold Prospectors Assn
Idaho Rural Council
Idaho State Governor's Office
Idaho Mining Association
Idaho Rocky Mountain Ranch
Igiugig Native Corporation
Iliamna Natives, Limited
Immanuel Congregational Church
Independence Mining Co. Inc.
Industrial Silica Sand Corp
Ingalik, Inc.
Inland Empire Public Land Council
Institute of Environmental Solutions
Institute for Policy Research Northwestern University
International Uranium Corp
Iowa Tribe of Oklahoma
Iowa Tribe of Kansas and Nebraska
Iqfijouaq Company
Isanotski Corporation
Island Mountain Protectors
J D Welsh & Assocs Inc
J.M. Beck & Associates
J.R. Simplot Company, Smoky Canyon Mine
Jackson Band of Mewuk Indians
James Heimler Inc.
Jamestown S'klallam Tribe
Jamul Indian Village
JBR Environmental
Jicarilla Apache Tribe
Johnson Matthey
Judith River Farm
K'Oyitl'Ots'ina, Ltd.
Kaibab-Paiute Tribe
Kake Tribal Corporation
Kaktovik Inupiat Corporation
Kalispel Business Council
Kalmiopsis Audubon
Kansas State Governor's Office
Karuk Tribe of California
Kasigluk, Inc.
Kavilco, Inc.Kaw Nation
KD Eng.
Keene Engineering Co
Kennecott Minerals Company

Appendix B: Recipients of the Final EIS

Kennecott Ridgeway Mining Company
Kennecott Exploration Company
Kennecott Utah Copper Corporation
Kennecott/Borax
Kern County Planning Department
Kickapoo Traditional Tribe of Texas
Kickapoo Tribe of Kansas
Kickapoo Tribe of Oklahoma
Kijik Corporation
Kikiktagruk Inupiat Corporation
King Cove Corporation
King Mineral Resources Inc.
Kinross Gold
Klamath General Council
Klawock Hennya Corporation
Kleinfelder
Kluckwan, Inc.
Knight Piesold
Knikatnu, Inc.
Kokarmiut Corporation
Koliganek Natives, Ltd.
Kongniglkilnomiut Yuita Corp.
Koniag, Inc.
Kootenia Tribe of Idaho
Kootznoowoo, Inc.
Kotlik Yupik Corporation
Koyuk Native Corporation
Koyukuk Mining District
Kugkaktlik, Inc.
Kuitsarak, Inc.
Kuskokwim Corporation
Kuukpik Corporation
Kvaerner Envir
Kwenthluk, Inc.
Kwik Inc.
La Posta Band of Indians
Lake Superior Greens
Land & Water Consulting, Inc.
Land Management Consultants
Land Management Services Inc
Land & Water Fund of the Rockies
Lander County Commission, NV
Landinfo Services
Lang Exploratory Drilling
Las Vegas Paiute Tribe
Laser, Inc.
Lassen County, CA
Law Offices of R. Vrooman
Le Tourneau Sales & Service Company
Levelock Natives, Ltd.
Lewis & Clark Water Quality Protection District, MT
Lewis & Clark County, MT
Lewistown District Resource Advisory Council
Lexam Explorations Inc
Li Treasure Hunters Club
Liberty Hill Mine
Lilburn Corporation
Lime Village Company
Lincoln County Public Lands Commission, NV
Little River Band of Pomo Indians
Los Coyotes Band of Mission Indians
Lovelock Paiute Tribe
Lower Elwha Reservation
Lower Brule Sioux Tribal Council
Lower Snake River Resource Advisory Council
Lucky Seven, Inc.
Lummi Indian Nation
Luzenac America Technical Center
Luzenac America Yellowstone Mine
Luzenac America, Inc.
Lyle Campbell Trust
Lyon County Public Lands Comm., NV
M-L LLC
Makah Tribal Council
Malin Lewis Distributing Company
Manokotak Natives, Ltd.
Manzanita Band of Mission Indians
Mar-Industrial Falk Renew
Maricopa Audubon Society
Marigold Mining Company
Marion County Board of Commissioners, MT
Mariposa Dredge Committee
Marshall Hill Cassas & De Lipkau
Mary's Igloo Native Corporation
Maserculiq, Inc.
Maxim Technologies
Mayer Equipment, Inc.
Mcclelland Laboratories, Inc.
McCoy/Cove Mine
McKenzie Flyfishers
MCZ
Mec & Echo Bay Mines
Meca Env Consultant
MEIC
Mendas Chaag Native Corporation
Meridian Gold Company
Mesa Grande Band of Mission Indians
Mescalero Apache Reservation
Metlakatla Indian Community
MGA Communications
Miami Tribe of Oklahoma
Middletown Rancheria of Pomo Indians
Miller Mountain Corporation
Mine Regulation Reporter
Mine Systems Design Inc
Mineral Policy Center
Mineral Policy Center Affiliation
Minerals Exploration Coalition
Miners Alliance
Mining & Environmental Services
Mining & Metl Society of Am
Mining Journal Ltd.
Minnesota Department of Natural Resources, Division of Minerals
Moapa Band of Paiute Indians
Modoc Tribe of Oklahoma
Mohave County Public Land Use, CA
Mojave Southern Great Basin RAC
Mono County Mining Committee
Montana River Action Network
Montana Department of State Lands
Montana Department of Environmental Quality
Montana Bureau Of Minerals & Geology
Montana State Governor's Office
Montana Environmental Information Center
Montana Trout Unlimited
Montana Mining Association
Montana Wildlife Federation
Moran & Associates
Morenci Unified School District, AZ
Morongo Band of Mission Indians
Mother Lode Goldhounds
Motten & Associates
Mountain Pass Wind Company
Mountain Messenger
Mountain States Legal Foundation
MPH Consulting
MT Environmental Information Center
MT Tunnels Mine
Mtnt, Ltd.
Muckleshoot Indian Tribe
Nambe Pueblo
Nana Regional Corporation
Napaskiak Corporation
National Wildlife Federation
National Outdoor Leadership School
National Regional Environmental
National Citizens' Coal Law Project
National Mining Association
National Research Council
National Association of Mining Districts
National Parks andConservation Assoc.
Native Village of Tetlin
Native Village of Venetie
Natural Resources Defense Council
Navajo Nation
Nebraska State Governor's Office
Nelson Lagoon Corporation
Nevada Assn of Counties
Nevada Colca Gold Inc
Nevada Wildlife Federation's Endangered Species Alliance
Nevada Division of Minerals
Nevada Wildlife Federation
Nevada State Governor's Office
Nevada Department of Administration
Nevada Department of Business & Industry
Nevada Department of Conservation & Natural Resources
Nevada Landmen's Association
Nevada Division of Wildlife
Nevada Mining Association
Nevada Boulder Opal
Nevada Cement
Nevada Legislature, Committee on Public Lands
Nevada State Clearinghouse
Nevada Division of Environmental Protection
Nevada Bureau of Mines & Geology
Nevada Miners and Prospectors Assoc.
Nevada Wild Horse Commission

Appendix B: Recipients of the Final EIS

New Gold
New Mexico Mining/Minerals Division
New Mexico Energy, Minerals & Natural Res
New Mexico Environment Department
New Mexico Office of Lieutenant Governor
New Mexico Mining Association
New Mexico State Governor's Office
Newberry Springs/Harvard Owners Assn
Newcrest Resources, Inc.
Newmont Gold Company
Newtok Corporation
Nez Perce Tribe of Idaho
Nima Corporation
Ninilchik Native Association, Inc.
Nisqually Indian Tribe
Nooksack Indian Tribe
North Start Borough Assembly, AK
North Santiam Watershed Council, OR
North Fork Rancheria of Mono Indians
North Dakota State Governor's Office
Northern Plains Resource Council
Northern Sierra Mining Council
Northern Cheyenne Tribe
Northern Alaska Environmental Center
Northern Stone Supply Inc
Northern State Supply Inc
Northern Utah Prospectors Assn
Northway Natives, Inc.
Northwest Cancer Center
Northwest Pipe
Northwest Mining Association
Northwest Montana Gold Prospectors
Northwestern Mutual Life
Novagold Resources Inc
NPRC
Nunakauiak Yup'ik
Nunamiut Corporation
Nunapitchuk, Limited
Oceanside Corporation
Office of the Governor-Jemez Pueblo
Oglala Sioux Tribal Office
OHM Remediation Services
Oil DRI Corp of America
Okanogan Highlands Alliance
Okeefe Drilling Company
Old Harbor Native Corporation
Olgoonik Corporation
Omaha Tribe
Omya CA Inc
ONDA
Orange County 49ers Inc
Oregon Department of Geology & Mining Industries
Oregon Natural Desert Association
Oregon Independent Miners
Oregon State Governor's Office
Oro Nevada
Orrick, Herrington & Sutcliff
Orvana Resources Corp
Osage Tribe
Oscarville Native Corporation
Otoe-Missouria Tribe of Indians
Ottawa Tribe
Ounalashka Corporation
Ouray County Alliance
Ouzinkie Native Corporation
P&H Mining Equip
Pacific Green Party
Pacific Sulfides
Paimuit Corporation
Paiute Shoshone Indians
Paiute Indian Tribe of Utah
Pala Band of Mission Indians
Parker Mining Co
Parsons Behle & Latimer
Pascua Yaqui Tribe
Paskenpa Band of Nomelecki Indians
Pathfinder Mines Corp
Paug-Vik Inc., Ltd.
Pauma Band of Mission Indians
Pawnee Tribe of Oklahoma
Pechanga Band of Luiseno Indians
Pedro Bay Native Corporation
Pegasus Gold Corporation
Pen Mar Historical Recovery Assn
People for the West
People for USA, Arizona
People for USA, Nevada
People for USA, Treasure Valley
Peoria Tribe of Oklahoma
Pete Lien & Sons
Phelps Dodge Corp
Phelps Dodge Tyrone
Phelps Dodge Mining Company
Phelps Dodge Exploration Corporation
Phelps Dodge Morenci, Inc.
Picuris Pueblo
Pilot Point Native Corporation
Pilot Station, Inc.
Pinoleville Rancheri Of Pomo Indians
Pinson Mining Co
Pit River Tribe
Pitka's Point Native Corporation
Pittston Nevada Gold Company
Pittston Mineral Ventures
Placer Dome Inc.
Placer Dome, Cortez Gold Mine
Planning Information Corporation
Pleuss-Staufer (California) Inc.
Pojoaque Pueblo
Polar Mining Inc
Ponca Tribe of Nebraska
Ponca Tribe of Oklahoma
Port Graham Corporation
Port Gamble S'klallam
Poudre Environmental Consultants, Inc.
Powder River Basin Resource Council
Power Resources, Inc.
Prairie Band Potawatomi Tribe of Kansas
Precious Metals Producers
Preston Gates & Ellis
Process Equipment Co
Prochnau-Sutherland Company
Progressive Leadership Alliance of Nevada
Project on Government Oversight
Project Underground
Prospector Shop
Protect Our Resources Coalition
Pruitt, Gushee & Bachtell
PTI Environmental Services Public Lands Foundation
Public Employees for Environmental Responsibility
Public Lands Foundation
Public Lands for the People Inc
Pueblo of San Juan Governors Office
Pueblo of Cochiti
Pueblo of Sandia
Pueblo of Acoma
Pueblo of Santo Domingo
Pueblo of Zia
Pueblo of San Felipe
Pueblo of Zuni
Pueblo of Isleta
Pueblo of Laguna
Puyallup Tribe
Pyramid Lake Paiute Tribe
Qanirtuuq, Inc.
Quadrangle Resources Inc
Quapaw Tribe of Oklahoma
Quartz Valley Indian Community
Quechan Federal Reservation
Quechan Tribe
Quest International Management Services, Inc.
Quileute Nation
Quinault Business Committee
R.A.M. Enterprise, Inc.
Radiation Oncology Services
Ramah Navajo Chapter
Rand Mining Company
Randal International
Rayrock Mines Inc
Redding Rancheria
Redi Insulation, Inc.
Redwood Valley Little River Band of Pomo Indians
Reno-Sparks Colony
Resource Development Council for Alaska Inc
Resource Design Technology Inc
Restoration Minerals Company
Rheox, Inc.
Rimrock Explosives
Rincon San Luiseno Band of Mission Indians
Rio Algom Mining Corp
Riverside Cement Company
Roadrunner Prospectors
Rocky Mountain Air & Lubrication, Inc.
Rocky Mountain Assoc Mineral Landmen
Rocky Mountain Ch. of the Sierra Club
Rocky Mountain Scout
Romarco Minerals
Root & Schindler, P.C.
Rosebud Sioux Tribe
Rough Country Drilling, Inc.
Round Mountain Gold Corporation
Royal Gold, Inc.
Royalstar Resources LTD
Rubber Engineering
Russian Mission Native Corporation
S.F. Phosphates
Sac and Fox Nation of Missouri
Sac and Fox Nation
Sagebrush Exploration
Saguyak Inc.

Appendix B: Recipients of the Final EIS

Saint Cloud Mining Co
Salamatof Native Association, Inc.
San Ildefonso Pueblo
San Pasqual Band of Mission Indians
San Carlos Apache Tribe, Tribal Planning Office
San Manuel Band of Mission Indians
San Miguel County Commissioners
San Juan Southern Paiute Council
Sanak Corporation
Santa Ynez Band of Mission Indians
Santa Rosa Indian Community
Santa Rosa Band of Mission Indians
Santa Ana Pueblo
Santa Ysabel Band of Mission Indians
Santa Clara Pueblo
Sauk-suiattle Indian Tribe
Savoonga Native Corporation
Sealaska Corporation
Seldovia Native Association, Inc.
Seminloe Nation of Oklahoma
Seneca-Cayuga Tribe
Sepa Resources
Seph-De-Ye-Ah Corporation
Seven Up Pete Joint Venture
Seven Oaks Ranch
Shaan Seet Inc.
Shaktoolik Native Corporation
Shea & Gardner
Shee Atika, Inc.
Shepherd Miller, Inc.
Sheppard Mullin Richter & Hampton Llp
Sherwood Valley Rancheria Of Pomo Indians
Shingle Springs Rancheria
Shishmaref Native Corporation
Shoshone-Bannock Tribes
Shumagin Corporation
Sierra Club, Grand Canyon Chapter
Sierra Club, Montana Chapter
Sierra Club, Toiyabe Chapter
Sierra Club, San Diego Chapter
Sierra Club, High Desert Committee
Sierra Club, Pajarito Group
Sierra Club, Rincon Group
Sierra Club, Santa Fe Group
Sierra Club California/Nevada RCC Mining Committee
Sierra Chemical Company
Sierra Nevada Mineral & Industry Council
Siletz Indians of Oregon
Silver Valley, Peoples Action Coalition
Singer Brown & Barringer
Siskiyou Audubon Society
Siskiyou Project
Sisseton-Wahpeton Sioux Tribe
Sitnasuak Native Corporation
Sivuqaq Inc.
Skokomish Tribal Council
Skull Valley Band of Goshute Indians
Small Mine Operators Association
Small Business Administration
Soboba Band of Mission Indians
Society for Environmental Truth
Solomon Native Corporation
Solutia
Sorptive Minerals Institute
South Fork Band Colony
South West Corporation
South Dakota State Governor's Office
South Dakota Office of School & Public Lands
Southern California Gem Industries
Southern Gila County Economic Development Corp
Southern Utah Wilderness Alliance
Southern Ute Tribe
Southern California Border Miners Assoc
Southwest Center for Biological Diversity
Southwest Stone
Southwestern Minerals Exploration Assoc.
Spearfish Canyon Preservation Trust Inc.
SPJV
Spokane Tribe of Indians
Sprungers Minerals
Squaxin Island Tribe
SRK
St.George Tanaq Corporation
St.Michael Native Corporation
Standard Industrial Minerals Inc
Standing Rock Sioux Tribal Council
State of Utah-DCED
State of Nevada, Human Resources
State of Arizona
State of New Mexico, Environmental Department
State of New Mexico, Department of Fish & Game
State of Wisconsin
Stebbins Native Corporation
Steffen Robertson & Kirsten, Inc.
Stewart Colony
Stillaquamish Board of Directors
Stillwater Computer Assistance
Stillwater News
Stillwater Protective Association
Stoel Rives Llp
Stuyahok, Ltd.
Summit Valley Engineering
Summit Valley Equipment
Summit Lake Paiute Tribe
Summitville-San Luis Valley
Summo USA Corporation
Sundance Ventures
Sunshine Mining & Refining Co
Sunwest Materials
Superstition Mountain Treasure Hunters
Suquamish Tribal Council
Susanville Indian Rancheria
Swan Lake Corporation
Swinomish Indian Tribal Community
SWOMA
Sycamore Valley Environmental Awareness Group
Sycuan Band of Misson Indians
Table Mountian Rancheria Federal Reservation
Taiga Mining Co
Tanacross Inc.
Tanadgusix Corporation
Taos Pueblo
Tatitlek Inc.
Te-Moak Tribe of Western Shoshone Indians
Technical Writer's Ink
Teck Resources
Teller Native Corporation
Tellurian Exploration Inc
Tesuque Pueblo
Tetra Tech
Thatcher Building Supply
The Gold Institute
The Surveyor's Exchange
The University of Chicago
The Conservation Fund
The Tulalip Tribes
The Chickasaw Nation
The Nature Conservancy
Thlopthlocco Tribal Town
Thomas Olsen, Associates, Inc.
Thompson Creek Mine
Three Affiliated Tribes
Tigara Corporation
Tihteet'Ali, Inc.
Toghotthele Corporation
Togiak Natives Limited
Tohono O'Odham
Tonkawa Tribe of Oklahoma
Tonto Apache Tribe
Torres Martinez Band of Mission Indians
Tovitna Limited
Tri-Star Design & Manufacturing
Tri-Con Mining Al, Inc.
Tri-State Truck & Equipement, Inc.
Tri Valley Corp
Tricon Metals & Services, Incorpoated
Trimac Transportation, Inc.
Trinidad Rancheria
Trout Unlimited
Tule River Indian Tribe
Tulkisarmute Inc.
Tuntunrmiut Rinip Corporation
Tuntutuliak Land Limitad
Tuolumme Band of Me-Wuk Indians
Tuolumne County Alliance
Turtle Mountian Band of Chippewa
Twenty-nine Palms Reservation
Twin Hills Native Corporation
TXI Riverside Cement
Tyonek Native Corporation
U.S. Representative Cannon's Office
U.S. Representative Schaeffer's Office
U.S. Representative Hayworth's Office
U.S. Representative Shadegg's Office
U.S. Representative Stump's Office
U.S. Representative Herger's Office
U.S. Senate Reid's Office
U.S. Army Corps of Engineers
U.S. House of Representatives, Committee on Resources
U.S. EPA, Region VIII
U.S. EPA, OFC Environmental Assmnt
U.S. EPA, Snake River Basin Field Office
U.S. Forest Service
U.S. Office of Surface Mining
U.S. Fish & Wildlife Service
U.S. Borax, Inc
US Pirg

Appendix B: Recipients of the Final EIS

Umatilla Reservation
Unalakleet Native Corporation
Unga Corporation
United Keetoowah Band of Indians in Oklahoma
United Auburn Community of Indians
University of Alaska, Fairbanks
University of Arizona, Mining & Geological Engineering
University of Arizona, Planetary Sciences
University of Nevada-Reno, Department of Mining
University of Utah
University of Montana
Upper Skagit Indian Tribe
Upper Lake Band of Pomo Indians
Upper Snake River Resource Advisory Council
Upper Columbia-Salmon Clearwater Resource Advisory Council
Uranerz USA
Utah School Trust
Utah Mining Association
Utah Dept. of Environmental Quality
Utah Oil, Gas & Mining
Utah State Governor's Office
Utah Geological Survey
Utah Gold Prospecting Club
Utah Rivers Council
Ute Indian Tribe
Ute Mountian Indian Tribe
Ute Indian Tribe Business Committee
Utu Utu Gwaitu Paiute
Valentine Mining Company
Vector Engineering, Inc.
Veex Company
Viceroy Resources
Viceroy International Exploration
Viejas Band of Mission Indians
Village of Andreafsky
Vista Gold, U.S. Inc.
VKO Mine Development Weaver District
W.R. Ryan Company
Wales Native Corporation
Walker River Paiute Tribe
Warm Springs Reservation
Washington Department of Ecology
Washington State Governor's Office
Washoe Tribe of Nevada and CaliforniaWells Band Council
West States Public Lands Coalition
Westech
Western Shoshone Defense Project
Western Mining Action Project
Western Mining Corporation
Western Arizona College
Western Governor's Association
Western Regional Council
Western Environmental Law Center
Western Organization of Resource Councils
Western States Minerals
Wharf Resources Partnership
Wharf Resources
Wheeler Machinery Co
White Knight Gold
White Mountian Native Corporation
White Mountian Apache Tribe
White Pine County Public Lands Commission, NV
Whitman & Company
Wichita and Affiliated Tribes
Wildlife Management Institute
Wind River Originals
Winnebago Tribe of Nebraska
Winnemucca Indian Colony
Women in Mining Education Foundation
Women's Mining Coalition
Woodfords Community Council
Woodward Clyde
World Rockhound Assn
Worthington, Lennart & Carpenter
Wranglell Research Council
WP CO Land Users Advisory Committee, NV
Wyandotte Nation
Wyo-Ben, Inc.
Wyoming Chapter of the Sierra Club
Wyoming Office of Federal Land Policy
Wyoming State Governor's Office
Wyoming Mining Association
Wyoming Game & Fish Department
Wyoming State Historic Preservation Officer
WZI
Yak-tat Kwaan, Inc.
Yakama Nation
Yankton Sioux Tribal Business and Claims Committee
Yavapai-Apache Tribe
Yavapai-Prescott Indian Tribe
Yerington Paiute Tribe
Yomba Shoshone Tribe
Young & Kester Attorneys at Law
Ysleta Del Sur Pueblo
Yuma County Board of Supervisors, AZ
Yurok Council
Zho-tse, Inc.
Zortman Mining, Inc.

INDIVIDUALS

Bent Aasquist
R.L. Abbott
Rick Achermann
Patricia Acker
Claude Ackerman
Teresa Adams
Norman Adams
Ron Adamson
Michael Aderhold
Butch Adkins
H. Adler
Joan Agamenoni
Edgaro Agosto
Joyce Ahern
Susan Ahern
Mike Ahrens
Don Ainsworth
Audrey Akhavan
Kathryn Alba
Sidney Alderman
James Alexander
Russell Allen
Duane Allen
N. Allen
Sylvia Allen
Stephen Allen
Gary Allen
Don Allen
Jennifer Allen
John Allen
Richard Allison
Richard Allison, Jr.
John Alonge
Tim Alpers
Stanley Alsing
John Ames
Adolph Amster
Robert Amidon
Betty Anderson
Darin Andersen
Dennis Anderson
Charles Anderson
Carl Anderson
Carol Anderson
Gary Anderson
Scott Anderson
Larry Anderson
Mark Anderson
Wade Anderson
Warren Anderson
Jeff Anderson
Linda Anderson
Jay Anderson
Kenneth Anderson
A.C. Anderson
Randall Anderson
Don Andrews
Jill Andrews
Cynthia Andrews
Dwayne Andrews
D G Angelos
Albert Anglin
June Anna-fey
Fred Antinora
Steve Antonioli
Peter Apostolakis
Alan Ardrey
Phil Arins
Steven Arita
Holly Arklin
J. Armbrust
David Armstrong
Timothy Arnold
Thomas Arnold
Robert Arnold
Clay Arnold
Earl Arnold
Phillip Ashcroft
Carole Ashworth
Ronald Askin
Cory Atiyeh
Marlene Atiyeh
David Atkins
Alfred Austin
Barbara Ayala
Donald Babat
Peter Babin
Jim Baca
George Baca
Cindy Bachman
William Bachman
Tom Bachtell
David Bacon
John Badovinac
Charles Bagley, Jr.
Sandy Bahr
Rod Baier
R. Bailey
Joan Bailey
Brent Bailey
Robert Baillie
Laurie Bair
Jerry Baird
Kenneth Baker
Daniel Baker
Eugene Baker
Gary Baker
John Baker
Ralph Baker
Oscar Balaguer
Anne Baldrige
John Balia
Sherman Ball
John Balla
Geoff Ballantyne
Sam Bamberg
Fred Banta
John Barber
James Barbour
Cathy Barcomb
Matt Bard
Bill Barger
Frank Barkanyi
Charles Barnard
Cheralyn & Randy Barnes
Phil Barnes
George Barnes
Robert Barnes
Mary Barraco
Dan Barrett
Steve Barrett
George Barrier
Steven Barringer
James Barron
Bob Bartholomew
Ralph Bartholomew
Richard Bartholomew
Michael Bartkoski
Dennis Bartlett
Joan Barton
Nathan Barton
Robert & Lesa Barton
Hank Bartos
Paul Bartos
Fred Bartow
Daniel Basketfield
Jim Bates
Stephen Bates
Karri Bath
Diana Batte
Edwin Battermann
Richard Baty
Paul Bauer
Dana Bauer
Jerry Baughman
Dale Baxter
Frank Baxter
Louise Bayard-De-Volo
Robert Bayer
Frank Bayhman
Mary Beager
Cassie Beals
John Bean
Edward Beard
Betty Beaver
T. Beaver
Jim Beck
Alison Beck-Hass
Jim Becker
Tim Becker
Brian Beckstead
Fred Bedall
Thomas Bedell
Richard Bedell
Richard Bedell, Jr.
Larry Beebe
Anne Beierle
Lilani Belad
James Belcher
Pam Bell
John Bella
Mark Belles
John Bellmon
James Belshe
Sharon Belton
Les Bender
Kathleen Benedetto
Stu Bengson
Julia Bengston
Robert Bennett, Jr.
John Bentley
Chuck Bentzer
Trish Berg
Larry Berg
Laura Bergener
Jim Bergener
Robert Berghaier, Jr.
Jeffrey Berman
John Bernardy
John Berst
James Berry
Hal Berry
Charles Bertelsen
Charles Bertolette
Bret Bessac
Frank Bessac
Ted Bethel
Avo Bethel
Richard Bettis
Fred Beuler
Howard Beuler
Steve Bicknell
Sam Bida
Tom Biggs
C. Bilbrey
Bill & Nancy Billingsley
Jack Billingsley
Dave Billingsley
Thomas Bingham
Gilbert Binns
Marion Birch
John Bishoff
Merrill Bitter
E. Bittner
William Bixby
Harvey Bjornlie
Frances Blacet
Phil Blacet
Ernie Black
D H Blackman
Christina Blade
Don Blade
Lee Blain
Russell Blalack
Tom Blanchard
Doug Bland
Blankenship
Debra Blanton
Dennie Blasingame
Greg Blaylock
Linda Bliss
Johnny Blizzard
Steve Blomeke
Jordon Bluestien
Carol Blumenthal
Ken Blunt
Darrell Blyths
James Boatman
Hal Boehm
William Boehme
Gibert Boeza
William Bodell
Robert Bogart
David Bogese
Douglas Boggan
Sam Boggs

Appendix B: Recipients of the Final EIS

Marcus Bohannon
Ralph Bohannon
E B Bohme
John Bonson
Steven Boone
Vera Boone
Robert Boor
Richard Booth
Chuck Borchard
Steve Borell
Benny Bossingham
Aimee Boulanger
Tony Bovee
Michael Bowen
Mark Bowling
Craig Bowman
Michael Bowman
Dr. James Bowns
Arleen Boyd
Alan Boyer
Dennis Boyle
Bob Bozzato
Fred Brackebusch
Susan Brackett
Bert Brackett
Brett Brackett Iii
Daniel Bradley
James Brady
Agnes Brailsford
Robert Brammer
Rick Branch
Dennis Brandt
Oliver Brangham
N L Bregenzer
J H Bright
Ray Brill
David Brinkley
Bob Brister
Jim Britell
Robert Brockman
Brent Bronson
Therold Brook
Gerald Brookman
Alexandra Brooks
David Brooks
Jo Ann & Robert Brooks
Lois Brooks
Fred Brossy
E E Broughton
Yvette Broussal
Judy Browing
Mike Brown
Mark Brown
Chris Brown
Brett Brown
Albert Brown
James Brown
Nancy Brown
David Brown
Kim Prown
Richard Brown
Quentin Browne
Jim Browning
Lee Brubaker
Joseph Brunner
Dennis Bryan
Kent Bryant
William Bryant
Karen Buckingham
Mark Buckles
Paul Buckley
Tricia Bueler
Fred Buescher
John Buffer
Alan Buffo
Debbie Bulger
Shelley Bull
Angelita Bullets
Gina Bulock
Shannon Bump
Mike Bunch
Burton Bundy
Denton Bungarz
Jon Bunning
Cherie Mae Buoy
Lois Burbridge
David Burch
Olive Burch
Robert Burdett
Burggraf
George Burghard
Peter Burk
Joyce Burk
Glynn Burkhardt
K Burkhardt
Mike Burl
Raymond Burleson
Arthur Burley
Dale & Gloria Burnell
H H (Hap) Burnett
Robert Burnham
Isabella Burns
John Burrows
Glen Burton
John Burton
Phyllis Burwell
Bill Bussman
Clyde Butler
Ray Butler
Jim Butler
Sharon Byram
Timothy Byron
Paul Cadruvi
Denise Cady-Smith
Greg Caffrey
Denise Calder
Nolan Caldwell
Kevin Call
John Callahan
Brent Callen
Edwin Calloway, Jr.
Lisa Calloway
Brad Campbell
L. Campbell
Mike Campbell
Douglas Campbell
Casey Campbell
Jeff Campbell
Christine Canaly
Roald Cann
Linda Cannell
Irene Cannon-Geary
Lreene Capote
Mario Capote
Kevin Cardin
Joseph Cardoza
Ron Carey
Barry Carlson
Bertha Carlson
Cathy Carlson
Gerry Carlson
Alan Carlton
Greg Carmichael
Ann Carpenter
Steven Carpenter
Jay Carr
Ruth Carraher
Frank Carrico
Fernando Carrillo
Lynn Carrington
Robert Carrington
John Carrol
John Carroll
Haila & Miles Carroll
Al Carsell
Max Carter
N T Carter
Roy Carter
James Carver
Jeff Cary
C. Casburn
James Case
Lawrence Casebolt
Larry Cassidy
James & Evelyn Caswell
Samuel Cateirsano
Barbara Catlin
Joseph Cavanaugh
Benjamin Cayetano
Abeyta Cecilia
Norm Cegelnick
Bill Center
Beverly Chadwick
Lyle Chadwick
John Chambelin
Sonia & Estelle
Chamberlain
John Chamerlin
Robert Chamberlin
David Chambers
Dennis Chambers
Richard Chance
Robert Chance
Sue Chance
Danny Charlie
Jeffery Chase
Larry Chase
Rocky Chase
Leon Chavet
Victor Chayet
Roberta Cheney
D Chenworth
Tonya Chenworth
Tom Chermin
Jim Chester
Vic Chevillon
Roger Child
J. Chisum
Frank Choate
Elton Chorney
Mike Christansen
Kent Christensen
Larry Christensen
Mike & Todd Christensen
Ron Christensen
Pam Christensen
Jerry Christie
John Christianson
Diane Christman
Lynn Christofferson
Ken Churchill
Richard Cimino
Donna Clancy
Robert Clancy
James Clark
Jack Clark
William Clark
Dana & Larry Clark
Dave Clark
Don Clark
Everett Clark
Gregg Clark
George Clark, Jr.
Shea Clark-Smith
James Clarke
Bill Clarno
Chip Clawson
Thomas Clayton
Noel Clinton
Nancy Clopton
Rich Clough
Wendell Coats
Mike Cochran
Doug Coe
Scott & Diane Coe
Stefanie Coeler
Wili Coeler
Greg Coffin
H. Coggin
William Cohrt
Constance Cole
George Cole
Jason Cole
David Cole
M Cole
Thomas Cole
William Cole
Donald Coleman
Timothy Coleman
Jim Collard
Will Collette
William Collins
Thomas Collins
Shan Collins
Clark Collins
Glendon Collins
Rick Collins
R. Collins
R. Collins, Jr.
Leta Collord
Robert Combs, Sr.
Bill Condit
Robert Cone
David Coney

Appendix B: Recipients of the Final EIS

George Conger
Jan Conley
James Conley
Donald Conner
Henry Conner
Teresa Conner
Robert Connor
Margaret Conradsen
Dick Conti
Jose Contreras
Adena Cook
Lin Cook
Michael Cook
Rick Cook
James Cooksley
Wendy Cooksley
Merril Coomes
Ed & Kathy Cope
Kathryn Corbett
Kartina Cord
Rudy Cordova
Rob Corkran
Russell Corn
James Cornelius
Frank Cornett
Jack Cornia
Elaine Cornish
Randy Cornish
Shawn & Dale Cosper
Kevin Costello
Tony Cotner
Ray Coulinke
Emily Cousins
Luis Covarrubias
Bruce Cox
William Cox
Bill Crabtree
Delwin Craig
Kim Craig
Leroy Cramer
Susan Crampton
Gary Crasberger
Bruce Crawford
J W Crawford
Carlyle Crecelius
Fred Crisp
Dennis Criswell
Buford Crites
Donald Crites
David Crocker
Phyllis Crolius
Elizabeth Crosby
Ray Crose
Eddie Cross
Thomas Crosslin
Trent Crotteau
Bob Croucher
Richard Crowley
Thomas Crowley
Deana Crumbling
Edmund & Joanna Crummey
Forrest & Elsa Crumpley
David Cruse
Palma Cullinane
Dean Culwell
Gary Cummings
E. Craig Cunningham
Curt Cunningham
Kirk Cunningham
Vesta Curry
Alan Curtis
Terry Curtiss
Ellen Cypher
Stephen D'Esposito
Jaak Daemen
Don Dahlgren
Paul Dahlgren
Rick Dale
Tad Dale
Paul Dale
Dan Dalgarno
Stuart Dalheim
Mary Dalmer
Leland Dammerich
Guy Dahms
William Danley
Judy Danner
John Darke
Wilma Darnell
Fred Darvill
Fernanda Dau-Fisher
Mike Davenport
Ian Davidson
Jennifer Davis
Charles Davis
Clint Davis
Randy Davis
Richard Davis
Robert Davis
Larry Davis
Lorraine Davis
James Davis
Jeremiah Davis
Denise Davis
Don Davis
Curt Dayton
Gary Dayton
Andrew De Garmo
David De Lazzer
Elizabeth & James De Niro
Franklin Deaver
Paul Deboo
Ray Decker
Jackie Deer
Nan Degelman
David Deheer
Donald Deines
Bradley Delaney
Bruce Delaney
Megan Delany
Mark Delaplaine
David Delasanta
Nickie Dellacioppa
Duane Delphy
David Delsordo
Stanley Dempsey
Lynn Demuth
William Deneef
Thomas Deneef
James Denison
Scott Denney
Marty Dennis
Ernest Dernberg
Brenda Despain
Domenico Detorres
Carl Detweiler
Tom Deutsch
Carl Dewitt
Pedro De Lo Fley
James Diamond
William Dibble
Gordon Dick
Eddie Dickerson
James Dickson
Ed Diekman
Mike Digiordano
Suzanne Dilks
Larry Dillard, Jr.
M. Dillon
John Dippold
Phillip Dirks
Mike Distefano
Mabel Dobbs
David Dolder
David Domgaard
Jim Donnelly
Mary Beth Donnelly
B J Donnelly
Dan Dorfschmidt
Andre Douchane
William Doughty
Neil Douglas
Raymond Dover
Luana Dowling
William Down
Harold Downey
Pat Downey
Michael Doyle
Roy Drake
Vivian Drake
Charles Dral
William Drennan
Terry Drever-Gee
Larry Drew
Michael Drinkard
Scott Driscoll
Kim Drossulis
Pat Droll
Leo Drozdoff
Steve Drummond
Roger Duba
Genevieve Dubois
Frank Dubois
Carolyn Duckworth
Julie Dudley
Doren Dudley
Susan Dudley
Don Duel
Marianne Dugan
Sara Duhamel
Dan Dumont
Kenneth Duncan
Lloyd Duncan
Susan Duncan
Joan Dunn
Larry Dunn
Max Dunn
Richard Dunsterville
Gale Dupree
Doug Duran
Don & Linda Durand
Bill Durbin
Harry Durham
Carlos Durosa
Myron Durtsche
Sally Dwyer
Darrell Dyer
John Eagan
Bob & Karen Ealy
Walter Eason
Ellyn Eberlein
Robert Eck
Dave Eckersley
Constantina Economou
Richard Eddins
Wendy Eder
Joy Edgar
Mary Edgin
Roger Edwards
Alan Edwards
Skip Edwards
Stacy Edwards
Kelly Edwards
Paul Edwards
Donald Egenberger
John Eggleston
Robin Eiseman
David Ekins
Greg Ekins
Lance Eklund
Charles Eldodt
Bo Elgby
Jim Elkins
Sherry Ellebracht
Catherine Ellefson
Jo Ellis
Mark Ellis
Bruce Eloff
James Elsbernd
Larry Ely
Marion Ely
Bruce Emerson
Karen Emerson
Robert Emerson
David Emery
Kevin Emmerich
Florence Emminger
Scott Endicott
Claire Englander
Stephen Engle
Thomas Engstrom
George Enneking
Peter Enticknap
Donald Equeberger
Rolin Erickson
Teresa Erickson
David Erley
Lyle Ernst
Nick Ervin
Alan Erwin
John Eslick
Brian Esser
Heather Estes

Appendix B: Recipients of the Final EIS

Antoinette Estrada
Glenn Eurick
Neil Eurick
Willis Evans
M. Evans
Patricia Evans
J. Evans
Frank Evans
John Evans
Karen Everitt
Deborah Evison
Rita Ewing
Ivan Ewing
D. Exline
Ted Eyde
Tom Faddies
Damian Fagan
Charlie Fahlgren
Jerome Fair
Linda Fanning
Lynda Fanning
Richard Farkas
Bruce Farling
R L Farnsworth
Dave Farnsworth
Donald Farquhar
Michael Farrell
Mike Farrow
Gary Farso, Sr.
Sarah Faulconer
Tom Faulkner
Lynell Fay
James Fellin
Donna Fenner
Cheryl Fenwick
Wait Fenwick
Harold Ferguson
Michael Ferman
Jami Fernette
Russ Field
Anne Fieler
Keith Fieler
Terry Fieseler
Wade Fifield
Phil Fikkan
Roger Filieo
Greg Firebaugh
Jay Fischer
Jerry Fish
Sara Fishkin
Cindy Fisk
David Fitch
Tom Fitzgerald
John Fitzpatrick
Mary Flagel
William Flanigan
Michael Flannigan
Jeff Flaxton
Gus Fleischli
Ernest Fleming
F. Fletcher
Paula Fletcher
Thurton & Carolyn Fletcher
Jo Ann Flyn
Larry Flynn
Roger Flynn
Valerie Flynn-Wallace
Mark Folks
Charlie Foote
Joshua Footer
Brian Ford
Bruce & Kathy Ford
Lindsay Ford
Michael Ford
Jack Foreman
Tracy Forman
Jeff Fornear
Erin Forrest
John Forrey
Keith Fougitt
Fred Fox
Kenneth Frailey
Tom France
Dale Francisco
Glen Franklin
Tom Fransway
Stan Frasier
Julie Frazie
Krista Frazier
David Frederick
Harvey Fredericksen
Sam Frederickson
Richard Frederking
Rick Frederking
W. Frederking
Curtis Freeman
Rick Freis
Jim French
Raymond French
Mert Freyholtz
H. Friesema
Bob Frisbee
Bob Fulkerson
R. Fullenwider
Stuart Fuller
David Funk
Duane Furman
Monique Furnish
Brian Furno
Robert Furtek
Al Gabaig
Charles Gabaig
Joan Gabelman
Celestino Gachupin
Della Gajus
Robert Gajus
Ernest Galbraith
Tom Galloway
Stephanie Gannon
Robert Garcia
Vince Garcia
Stan Gardner
Mike Garfield
Kathleen Garland
Howard Garr
Patrick Garretson
Tim Garrod
Shirly Garthwait
Bob Gartner
Michael Garverich
Lydia Garvey
Dave Gaskin
Joe Gassaway
Cindy Gaydos
Michael Geary
John Gebhardt
Al Gedicks
Cindy Gee
Del Gehrett
Dean Gehring
Robert Gelsky
Joseph Gembha
William George
Ronald Gerdes
Ronnie Gerdes
Jim Geringer
Jean Gerth
Tom Gesick
Michael Giannotto
Mark Giese
Ron Ghiley
Sally Gibert
Terry Gibson
Stanley Gigson
Steve Gilbert
Alan Gilda
Wesley Gildart
Robert Gilder
Robert Gile
Dori Gilels
Jerry Gill
Eddy Gillespie
John Gilmore
Michelle Gilmore
Mike Gilmore
Dan Givens
Jeff Glass
Steve Glass
Mike Glasson
Paul Glavinovich
Donald Glen
Robert Glick
Glidden
Cindy Glock
R. Glynn
Maxine Goad
Lee Gochnour
Jonathan Goddard
David Godlewski
Wayne Godwin
Thomas Godzicki
Henry Goetz
Pete Goichoechea
Michael Golden
Sarah Goldfine
Walter Goldstein
Manuel Gomez
Margaret Gomez
Josie Gonzales
Julio Gonzales
Olga Gonzales
Pablo Gonzalez
Rodolfo Gonzalez
Shawn Gooch
Donna Goodale
Gary Goodrich
Bill Goodsell
Peter Gordon
Arnold Gore
Helen Gormley
Mark Gornick
Bob Gosik
Charles Gould
Jay Graf
Ted Graf
Estella Graf
Sam Graham
Mel Graham
John Graham
Reba Grandrud
Bruce Grange
Christie Granquist
Michael Grant
Bill Gray
Gary Gray
Robert Green
Russell Green
James Green
Ed Green
Gregory Green
Dave Greenan
Kenneth Greenwell
Alan Gregory
Joe Gregory
Kristie Gregory
Francees Gregovich
Melanie Gretch
Joseph Grieger
Jeffrey Griffin
Mike Griffith
Ruben Griffith
Karen Gross
Thomas Gross, Jr.
F M Grove
Timothy Grover
Bill Grover
William Grow
Mike Gryvnak
Benjamin Guenther
Robert Guerin
Herman Guerrero
Rick Guillemin
Tracy Guinand
Kenny Guinn
Edward Gulley
Richard Gumm
Kathleen Gundy
William Gunter
B. Gurley
Gary Gustafson
Lewis Gustafson
Joseph Gutkoski
Carl Gutierrez
Terri Haag
Jake Haas
M. Haase
Donald Hacker
James Hadley
Bea Hageman
Jim Hagen
Jerry Haggard
Peter Hahn
Greg Hahn
Thomas Hains

Appendix B: Recipients of the Final EIS

Lyn Hairy
James Hale
Boies Hall
Denis Hall
John Hall
Lois Hall
C. Hall-Cottrill
Sue Hallett
David Halligan
Catherine Halsei
William Halver
Daniel Hambilton
Stanley Hamilton
Julie Hamilton
Norma & Patrick Hamilton
Geri Hamlet
Ralph Hamm
Richard Hamm
Dick Hammond
Doug Hammond
Ruben Hancock
Robert Handelsman
Christina Hanis
Jerry Hanley
Karl Hanneman
Doug Hansen
Jay Hansen
John Hanson
Michael Hanson
E. Haraughty
Ellwyn Harbeck
Dwight Harbaugh
Byron Hardie
Adella Harding
Russell Hardisty
Jess & Jan Harkness
Anna Harlowe
B. Harms
Howard Harmston
Archie Harper
Diane Harrigan
Jerry Harrington
Susie Harrington
Tom Harris
Dave Harris
Chris Harris
Cheryl Harris
Jeffrey Harris
Samlee Harrison
Steve Hartman
Mary Hartung
Gary Harvey
Douglas Harwood
Richard Hasler
Bill Hatch
Steve Hatfield
Jim Hatt
Charles Hattendorf
E. Haub
Jim Haviena
Kerry Hawkins
Tom Hawkins
Denny Hawley
Stan Haye
Chris Hayes
Michael Hayward
Hal Hazan
Elsa Head
Derek Heafey
Craig Hebberd
Amy & Jack Heck
Kenneth Hecker
Vincent Hecker
William Hedglin
Kevin Hegerle
Spence Hegstad
Carl Hehnke
Bonnie Heidel
James Heimler
Dan Heinz
Fred Heivilin
Harold Helgeson
Kenneth Hell
Steve Hellem
Gary Hellier
Arne Hellman
Patricia Helvey
Dwight Henderson
Gerald Henderson
John Hendricks
John Hengen
Randy Henkle
Michael Henkoski
Scott Hennessy
Quinton Hennigh
Gary Henning
Mae Henning
Donald Henrick
Joan Henroid
Ryan Henson
John Hensyel
Christopher Herald
John Herberg
Charles Heringer
Jason Herrin
Jim Herring
Steve Herron
Ivan & Betty Hess
Ron Hess
Mary Hess
Randi Hetrick
Pat Hettinger
Bernard Hiatt
Marvin Hiatt
Ron Hibbert
Tim Hibbs
Harold & Wilma Hicks
Steve Hicks
Jimmie Higgins
Mike Higgins
Sandy Higgins
Elayne Higley
Nancy Hilding
Charles & Alva Hill
John Hillenbrand
Cloyce Hilsinger
Conrad Hinshaw, Jr.
Bob Hirsch
John Hirsh
Anne Hite
Ron Hoagland
Phil Hocker
Cathy Hocker
Mike & Eileen Hodges
Harold Hoesberg
Rich Hoffman
Stephen Hoffman
Mark Hogan
John Hohstadt
Victor Holanda
Sue Holbert
Edward Holcomb
George Holcomb
J. Holfit
Dee Holladay
John Holleman
Hollestelle
Kay Holmes
George Holton
John Holzheimer
Raena Honan
Justin Hopkins
Lee Hopkins
Norman Hopland
Harry Horak
Edward Horgan
Tanya Horn
Paul Horton
Pat Hosemann
Kazuhiko Hotani
Alicia Hough
John Householder
Van Housman
Bill Houston
Ellis Howard
Phillenore Howard
Dan Howard
Bruce Howard
Mike Howard
Ralph & Wilma Howarth
Lynn Howe
Kay Howe
Harold Howell
David Howell
Charles Hower
Foster Howland
Randy Hubbard
Rod Hubbard
Carolyn Hubble
Jeff Huff
William Huff
Eleanor Huffines
Nancy Huffman
Jon Hughes
Glenda Hughes
Richard Hughes
Daniel Huisentruit
Patricia Hulce
Jane Hull
Jeanne Hum
William Hunkaby
J. Hunnicutt
Glen Hunsacker
Buster Hunsaker
Richard Hunt
Norlan Hunt
Doug Hunt
Blake Huntley
Patrick Hurley
Rick Hurst
Tahir Husain
Brian Huse
Bonnie Hutchings
John Hutchins
Joseph Hutchins
Linn Hutchins
Mark Hutchinson
Lorena Hyde
John Hyde
Christopher Hyle
Alan Ice
Hugh Ingle, Jr.
Shirley Inman
Heath Inskip
Manford Insley
Mark Ioli
Wayne Ion
Marianne Isbister
Nellie Israel
Brian Iverson
Robert Ives
Twila Ives
Tedd Ivers
J. Jacks
Lisa Jackson
Stewart Jackson
Edward Jackson
Abe Jacobson
M. Jagoe
Laurence Jahn
John Jakobowski
Norman & Wilma James
Patricia James
Eric Jameson
Norman Jangen
Henricus Jansen
Peter Janss
Norman Janzen
Michael Jasper
Stephen Jarvis
Gerald Jayne
Chuck Jeannes
David Jenkins
Dave Jenkins
Don Jennings
Terry Jennings
Walter Jennings
James Jensen
Jeff Jensen
Lyle Jensen
Bill Jensen
Thomas Jensen
Bart Jenson
Shane Jimerfield
William Jobe
Tom John
Alan Johns
Cindy Johnson
Martin Johnson
Mike Johnson
Clive Johnson
Gary Johnson
George Johnson
Tammy Johnson

Curt Johnson
Erin Johnson
Bradley Johnson
Bruce Johnson
Donald Johnson
Henry Johnson
David Johnson
Brian Johnson
Robert Johnson
Raleigh Johnson
Tim Johnson
Tom Johnson
Brit Johnson
Steve Johnson
Jim Johnson
J M Johnson
Val Johnson
Xa Dwight Johnson IV
Lahsha Johnston
Dennis Johnston
J C Jones
Norman Jones
Laurie Jones
Lucy Jones
Nathan Jones
Harry Jones
Denise Jones
Decron Jones
Paul Jones
Martin Jones
Clifford Jones
Cedron Jones
Harold Jones
R. Jones
Dave Jones
Gayland Jones
Stuart Jones
Dave Jonson
Rick Jordan
Lynn Jorgensen
Darryl Jorwik
Beth Judy
Russell Judy
Kent Just
Michelle Kaelke
Mike Kahoe
Raymond Kamps, Clu
Edward Kane
Jeffrey Kane
Terrence Kardong
W. Kari
Carol Kasza
Tracy Katelman
Paul Kath
Jim Katzke
Erol Kaya
Joe Keeley
Raymond Keenan
Robert Kegley
Bill Keiry
Tom Kell
Linda Keller
P R Kellogg
J H Kells
Jim Kelly
Bruce Kelvin
William Kemp
Dirk Kempthorne
Houston Kempton
Kenneth Kempton
Lillian Kendall
Paul Kendall
Roxanna & Heston Kendall
Sara Kendall
Colin Kendell
Anna Kendrick
Terry Kendrick
Brian Kennedy
Bruce Kennedy
Glenda Kennedy
William Kennedy
Lawrence Kennedy
Peter Keppler
Dan Kerback
Steven Kerns
Nancy Kersey
Carolyn & Arnold Keskulla
Jerry Kidd
Carol Kienenberger
Carl Kilefner
Enda Mills Kiley
Dana Kilgore
Samantha Kilgore
Philip Kilgour
Don Killgore
David Kimball
Shepard Kimbrell
Linn Kincannon
Stanley Kinder
Elden Kinderknecht
Warren King
Jean King
Jeanne King
Lyle King
Tracey King
M. King, Jr.
Kevin Kingma
John Kinkelaar
Kevin Kinsall
Spencer Kircher
Kevin Kirkeby
John Kirkham
William Kirkpatrick
Edward Kirwan
Karl Kiser
Tom Kitchar
John Kitzhaber
Joseph Kizis
Trish Klahr
Gene & Rose Klefman
Richard Klein
Eric Klein
James Klein
Mike Klein
Rose & Paul Klemenok
John Klick
Edwin Kliegman
Dan Kline
Nick Kloepping
Charles Knepper
Paul Kniffel
Laura Knight
Matt Knight
Ted Knight
Loretta & Edward Knittel
Keith Knoblock
Arlo Knoll
William Knovicka
Tony Knowles
Paul Knox
Raymond Lee Kobler
Thomas Koch
Janissa Koelsch
W B Kohlmoos
Ralph Kolbush
Mike Konen
Larry Kornze
Mary Korpi
Terri Koscinski
Debbie Kovar
William Kraemer
Kenneth Krahulec
Larry Krals
Caroline Krater
Kevin Krauklis
Joseph Kraus
Marilyn Krause
Ray Krauss
Loren Kreck
Jon Krecker
Ray Kreig
Judy Kreps
Franklin & Doris Krugen
Mark Kuhn
Gene Kulesza
Dan Kump
Russell Kunick
Gary Kuroski
James Laage
William La Bouff
Milton La Due
Doug La Follette
Gayle La Pointe
Rene Laberge
Kimberly Lacey
Dave Lacey
Lacy
Harold Ladd
Denise Laes
Brian Laflamme
Larry Lafrentz
Joseph Lambert
Rick Lambert
Venita Lambert
Laurie & Michelle Lamont
Dick Lance
Stephen Lance
Rod Landblom
Andy Lande
John Landreth
Raymond Landry
Guy Lane
Joe Lane
Sandra & David Lane
Stewart Lange
Duane Langley
David Larkin
Clifford Larsen
Richard Larsen
Douglas Larson
Gregory Larson
Burel Larse
Pat Larse
Charles Lassiter
Patrick Lassiter
Thoma. szlo
Laura Lauber
Rick Laudenslager
Jean Lauren
Tracy Lavarnway
Jeffrey Lavender
N. Law
A L Lawrence
Eric Lawrence
Brad Lawrence
Lynn & Arlie Lawrence
Richard Lawson
Scott Lawson
Mel Lawson
Kerry Lawson
Jason Laya
Sam Layne
Tom Lazelle
Bernard Lea
Douglas Lear
Grant & Sandra Leavell
Marcy Leavitt
Duane Leavitt
Jim Leavitt
Michael Leavitt
Phillip Lebednik
James Lebret
Steven Lechner
Ellyn Lee
Francis Lee
Bryan Lees
Robert Lefaivre
Diana Lefler
Rebecca Leingang
Albert Leniz
Hank Lesinski
James Lessard
Jack & Nancy Lester
Jack Leuf
Lainie Levick
Mark Levin
Mary Levoir
James Lewis
Lane Lewis
Ethel Lewis
Flc Lewis
Fred Lewis
Todd Lewis
Malin Lewis
Frank Lewis
Patricia Lewis
Kim Lexa
Mike Leyva
Gaul Lichfield
Suzanne Licht
Ole Lievestad
Jack Liggett
Bill Lind
Herman Lindemann

Michael Lindholm
Laura Lindley
Doug Lindsay
Henry Lischer, Jr.
Thomas Lisek
Kay Little
Chet Littledyke
Carl Littlefield
David Litvin
Merle Litzinger
Robert Livingston
Sid Lloyd
Ben Locatelli
Gary Locke
Mike Logan
S A Lohrke
Walter Lombardo
Sheila Longnecker
Tom Loomis
Marion Loomis
Maxine Lopez
Dan Lopez
Gregg Lptien
Chris Lord
James Lounsbury
J Louthan
Darrell Loveland
Jerold Lovich
Richard Lower
Dirk Lowther
Jerry & Sherri Lozinski
Patricia Lucas
Eric Lucas
Dan Lucas
William Lucas
Dave & Cathy Lueders
Walter Lukowski
Douglas Lupo
Sonda Bates Lupo
Ralph Luther
John Lutley
Gordon & Nancy Lyford
Bill Lyle
John Lyle
Jack Lyman
John Lyman
Willy Lynch
Gary Lynch
R. Lyngby
Gillian Lyons
David Lytle
Anita Macfarlane
Craig Mach
Suzanne & Ron
Mackelprang
John Mackinney
Dianna Macleod
Rod Macleod
Frank Macmurray
Edward Madern
Bernice Maertz
Janette Magee
Doug Magee
Rick Magstadt
Joe Maher
Edward Mainland
Lyle Majeska
Clifford Maki
Janice Makiney
Jeff Malmen
Julie & Ken Maloney
Jessi Maloney
Lucky & Mary Mancini
J. Maneth
V. Mangus
Scott Manske
Joni Mansel
Christopher Mapes
Lori Maranto
Thomas Marconi
Steve Marell
James Margason
Alex Marinello
Jim Marks
Steve Marks
Kelly Maroti
Jason Marsden
Timothy March
John Marchese
Gwen Marshall
Kathleen Marshall
Dennis Marsing
Dallas Martin
Douglas Martin
Anne Martin
Walt Martin
Claire Martineau
R. Martineau
Georgia & John Marx
Susie Mason
Herbert Mason
John Mason
Bob Mason
Rex Massey
Tom Massie
Tony Massih
Jason Mastrine
Ardell Mathews
Bryce Mathews
Michael Mathews
Erin Mathews
Kay Mathews
Harold Mathews
Ernest Matson
Kevin Matthes
Robert Mattox
Terry Mattson
Dean Matzat
Steve Mauney
Pamela Mausner
Charles Maxwell
Jacqueline May
Darrell Mayberry
Jim Mayers
Jay Mayhew
Lillian Maynard
Lisa Mayo
Bill Maze
C. McArthur
Hya McCall
Jim McCarthy
Daniel McCarty
William McCarvill
Gene McClelland
Allen McClintick
Dave McClure
Donald McCmillan
O. McCook
Phyllis McCormack
Harold McCormick
Dan McCoy
Gordon McCoy
Steve McCoy
Tim McCrum
Betty McCue
Carroll McCulloch
Thomas McCully
Richard McCutchen
Larry McDaniel
James McDermand
Charles McDonnell
Brad McFadden
Glenn McFall
Annette McFarland
Michael McFarland
Curtis McGann
Joyce McGarry
Kenneth McGarva
Michael McGath
Sam McGeorge
Doug McGibbon
Timothy McGowan
Robert McGowan
Dan McGrane
Mike McGrath
Madelen McGregor
Steve McGuire
Joseph McGurrin
Michael & Joann McKay
Andrew McKean
Jeromy McKinnon
Bob & Karen McKowen
Wayne McLain
David McLean
Gary McLearn
Sally McLeod
Don McLeod
Vance McMahan
Annie McManus
Don McMillan
Gordon McMillian
Page McNeill
Bill McNulty
Teresa McPherson
Keith McPhilimy
Keith McRobert
Douglas Mead
Dan Mead
Stanley Meager
Robert Meckley
Jodi Medlar
John Meeks
Brad Meiklejohn
James Melchior
Karen Melfi
Jay Melnyk
Vivian Menaker
Mary Menetrey
Dean Menge
Jo Anna Meninick
Scott Mernitz
John Merz
Robert Messinger
Susan Messler
Terry Metz
Catherine Meuller
Alan Meyer
Stanley Meyer
David Meyers
April Michalski
Robert Michalski
Stephen Micklas
Marcus Middleton
Maureen Miemi
Richard Milanovich
April & Brent Miller
Joe Miller
Barbara Miller
Mark Miller
Neil & Jennifer Miller
Sheldon Miller
David Miller
Richard Miller
Eillard Miller
Jim Milligan
Ernest Milligan
David Milliken
Star Mills
Dewayne Mills
Lonnie Mills
Clark Milne
Bill Milton
Mark Minter
Reymundo Mireles
Greg Mirich
Hank Miser
Michael Miskowski
Mike Misner
T. Mitchell
Jim Mitchell
Miles Mitchell
Dal Moellenberg
Cherlynn Moes
Richard Mohr
Jean Mold
Mike Mold
Christina Moncibaez
Tom Monforton
Kelly Monier
Melissa Monk
John Monroe
Sam Monteleone
Mel Montgomery
Jeff Moore
Russell Moore
Haynes Moore
Scott Moore
Loren Moos
Denny Moosman
Freddie Moraga
Robert Moran
Steve Morehouse
Authur Morgan
Jim Morgan

Appendix B: Recipients of the Final EIS

Roy Morgan
Hazel Morphis
Steve Morrell
Delks Morrill
Janet & Paul Morrison
Lee Morrison
Elvin Morse
Robert Morse
Mark Morse
Charles Mortensen
Richard Mortenson
Janet Morton
Miriam Moyas
Harry Mosby
Stephen Moser
Donald Motley
Roger Motten
Mike Moutray
Michael Mower
Jim Mack
John Mudge
Joyce Muir
Tom Mulgren
Jim Mulhall
Sean Mullen
Earle Mullen
Guadalupe Munoz
Terry Munson
Mary Munson
Donald Murphy
Loren Murphy
Susan Murphy
Floyd Murray
Jason Murray
Sharon Murray
Shirley Muse
David Musgrave
Brian Musser
Jim Mustra
Bob Myers
Tom Myers
Jim Nagel
Richard Nanna
Rachel Nava
Chuck Neal
Melva Neal
John Neal
Wayne Neff
Brian Neilson
Glenn Neilson
Anton Nelson
Duane Nelson
Mark Nelson
Eloise Nelson
Charles Nelson
Tom Nelson
Robert Nelson
Larry Nelson
Launa Nessl
A W Neustedt
Bruce Newbery
Don Newhouse
Earl Newland
Gail Newton
Norman Nicholls
Dave Nichols
Harold Nichols
Larry Nichols
Kent Nicholson
Tom & Julie Nicholson
Tom Nickles
Jim Niebaum
Patricia Niebaum
Dianne Nielson
Preston Nieson
Rob Nigg
Daniel Nixon
Mike & Ralph Nolen
Scott Norby
Mary Nordale
Bob Nordstrum
A. Norris
Brian Norris
Dottie Norton
Ruth & John Norton
Dick Notmeyer
Lee Nugent
Marshall Nunn
Burl Nunn
David O'Connell
Peter O'Conner
David O'Donnell
Janet O'Crowley
Danny O'Neill
Martha Oaklander
Tim Obole
Ochoa
Oscar Ochoa
Robert Odell
Al Odermann
Dimitri Oganessianfs
Laura Ohanian
Steve Olafson
Bob Oliver
Sara Oliver
Timothy Oliver
Larry Olsen
Thomas Olsen
Luana Olson
R. Olson
Frank & Lorraine Ondricek
William Orchow
Juan Ornelas
Robert Orser
Marcus Osborn
Jeanne Osborn
Tad Osman
Edmond Osteen
Phil Ott
Goldie Otters
David & Kathryn Owen
David Owens
O. Owens
Bill Owens
Eladio Pacheco, Jr.
Walt Pachucki
Julia Page
Steve Page
Jerry Palmer
Susan Pancare
Bernadette Pangersis
Frank Pangersis
Dave Paquin
Bruce Parke
David Parker
Robert Parker
Doug Parker
Gary Parkin
Craig Parkinson
Suzanne Parkinson
Richard Parks
Bruce Parks
John Parks
Rick Parlett
Delbert Parr
Ronald Parratt
Conrad Parrish
Johana Parrish
Mathew Parrish
Jeff Parshley
Perry Parsons
John Paterfield
Will Patric
Thomas Patrick
Cora Patterson
Allen Pauer
Chris Paulsen
Marilyn Paxton
Val Payne
Jim Peaco
Gordon Peake
Jimmie Peal
Jeffrey Peace
Lewis Pearce
Shayne Pearce
Carl Pearson
Pat Pearson
Donald Peay
Connie Peck
Henry Peck
James Peck
Gerald Peebler
Scott Peebler
James Peek
Craig Peer
John Pekrul
Raymond Pendergast
William Pennant, Jr.
David Penney
R. Pennington
Larry & Laveta Pennock
W. Penny
Curtis Pepper
Ina Perce
Bradley Perkins
Terry Perkins
Janet Perrigo
Melvin Perry
Vern Personett
Carl Pescio
Janet Pescio
Joe Pescio
Robert Peter
Gene Peters
Mike Petersen
Kent Petersen
Ellis Peterson
Mike Peterson
Ron Peterson
Daniel Pettengill
George Pettyjohn
Jack Phillips
William Phillips
Charles Phillips
Robert Phipps
Charles Picard
Lewis & Joanna Picher
Gary Picker
Art Pierce
Jennifer & Linda Pierce
Edward Pike
Larry Pilster
Douglas Pineo
Ralph Pingrossi
David Piquet
T Piquet
Tom Pitney
Carmen Pitt
William Platts
Harold Plum, Jr.
Darla Poag
Don Poggi
Alan Politte
Robert Pollock
Robert Popp
Genna Porter
Mary & William Porter
Bev & Bill Post
Donald Potts
Shiloh Poulter
Dan Powell
Randy Powell
Randy Powelson
R R Poyorena
Sharon Prager
Roy Preator
Mel Preckel
Michael Pressman
Anthony Price
Jack Price
James Price
Jim Price
Robert Price
S M Price
Linda Priest
Bob Primbs
June Primbs
Richard Prior
Victor Pritchard
Carole Probert
Todd Prowess
Louis Profit
Steven Proscia
Harold Provonsha
Leo Pruitt
Richard Pruitt
Robert Pruitt, Jr.
Shali Puls
Dan Purvance
Douglas Putman
Ken Pyles
John Pyper
Steven Quarles
Ella Quay

Appendix B: Recipients of the Final EIS

Lorraine Quinn
Joseph Quintana
Eysebio Quirrero
Brett Rabe
Peter Rabin
Marc Racicot
Denyse Racine
Larry Raddon
Bruce Raden
Mike Raffath
Mike Rains
Rudolph Raman
Doug Rand
William Raner
Michael Ranger
Wayne Ramsey
Ronald Rapier
Derek Rapier
Mark Rapkoch
Ronny Rardin
Richard Rasmussen
Sarath Ratnayake
Geoff Rauch
Jane Ray
Larry Raymond
Malcolm Rea
Carolyn Rebholz
Chuck Rech
Charles "Hardy" Redd
Jim Reddy
Jill Reed
Leroy Reed
Lynn Reed
Linda Reed-Jerofke
Don Reeder
Elaine Rees
Richard Reeve
Leatha Reeves
Michael Regan
John Reginato
Linda Regnier
Woody Rehanek
Doug Reichenbaren
Richard Reid
Christine Reilly
Bernard Reilly
Kenneth Reim
Scott Remington
Fritz Rennebaum
Bob Ressler
Fred Retzlaff
John Reynolds
Norma Reynolds
Omdeir Reynolds
Jerry Reynoldson
Greg Rheam
Richard Rhoads
Freddy Rhodes
James Rhyne
James Rice
Scott Rice
Eldon Rice
Jeremy Richan
Leo & Donale Richan
Mayfield Richard
Ronald & Helen Richards

Bill Richardson
Gary Richardson
Donali Richau
Scott Richey
Theona Richie
Merle Richmond
Kathy Richmond
Virginia Ricketts
Ron Ricketts
John Rico
Dave Riddle
Cynthia Riddles
Laura Riemache
Theron Riley
Anna Rinaldo
Frank Rinaldo
Kevin Ringdal
June Ringer
David Ringquist
Lenny Ripplinger
John Risbel
John Ritchey
Bobbie Ritchie
Scott Ritchie
Troy Rittgers
Dan Ritzman
Robert Rivera
Walter Rivers
Daniel Rix
Julie Rizzo
Authur Robbins
David Robbins
John Roberts
Kathy Roberts
Craig Roberts
David Robertson
Ernie Robinson
Roger Robinson
Helen Robinson
Otis Robinson
Raymond Robinson
George Robinson
Kevin Robinson
Gordon Rodda
Terri Rodefer
Howard Rodgers
A. Rogers
Clayton Rogers
Joseph Rogi
Emil Romagnoli
Joe Romero
Christa Romppanen
James Roots
Donna Rosborough
Olga Rosche
Patti Rose
Barry Rose
Elyssa Rosen
Helene Rosenberg
Gerrit Rosenthal
Nathalie Rosin
G. Ross
Carl Rouch
Keith Rouch
A. Rovig
Terry Rubin

James Ruddock
I. Rudy
Hugh Ruebush
Hector Ruelas
Joseph Ruetter
David Ruiz
Richard Rukavina
Walter Rule, Jr.
Joseph Rumberg
Robert Rumir
William Rundquist
Samuel Rushforth
Luke Russell
Don Russell
George Rutter
Kevin Ryan
Pat Rylance
Jennifer Salisbury
David Salisbury
Diana Salisbury
Robin Salthouse
Doug Salvesen
Robert Sammons
Otis Sampson
Terry Sampson
Walter Sampson
Susan Samuelson
Amy Sanchez
Adella Sanchez
Castulo Sanchez
Michael Sanders
Richard Sanderson
Stuart Sanderson
Alice Sandoval
Andrew Sandoval
Robert Sanregret
Jay Santos
Richard Sargent
Sili Sataua
L M Saterfield
John Savarese
Gulbekin Savci
Stephen Sawey
Wayne Sayer
Judy Sayler
Ronald Sbraglia
Tom Scartaccini
Robert Schaale
Edward Schafer
T. Schaffer
Ron Scharf
Darrell Scharf
Jack Scheall
Ed & Bonnie Schein
Sanford Schemnitz
Marina Schenk
Robert Schenk
Mike Schern
Joseph Scheuering
Craig Schiffries
L A Schildberg
Ron Schindler
Wayne Schlegel
Charles Schlicht
Craig Schlittler
George Schmidt

Paul Schmidt
Ron Schmiermund
Daniel Schneider
David Schneider
Robert Schneiger
Herman Schob
Ben Schole
Steve Schombel
Roger Schorg
Elaine Schrader
Franklin Schroeter
Steven Schubert
Robbie Schultzen
Reid Schuller
Michele Schummer
Lenard Schwab
Alan Schwartz
William Schwarzkoph
A. Schweizer
Ruth Ann Scola
Michael Scott
Warren Scott
William Scott
Verna Scratch
Tim Scullen
Thom & Jette Seal
Kurtis Sears
Paul Seccomb
Darryl Seeley
Bjorn Selinder
Chris Sellstone
John Semone
Richard Sence
Billie Senik
Michelle Sense
Lance Senter
Gene Sentz
Suzanne Sessine
George Seuffert
Lesa Sevin
Mary Sexton
Pete Shabeshari
Judy Shackford
James Shannon
James Shannon Jr.
Richard Shannon, Jr.
James Sharp
Sam Sharp
Chris Shaw
Buddy Shaw
M S Shay
Katy Sheehan
Marcie Sheehan-Kerner
Wesley Shelberg
Ken Shelley
Thomas Shelley
Richard Shepard
Austin Shepherd
Holland Shepherd
Byron Sher
William Sherill
Lew Sherman
Paul Sherrell
Pat Sherrick
Charles Sherry
Roger Sherwood

Appendix B: Recipients of the Final EIS

Chuck Shipley
Glen Shipp
Lucy Shipp
Thor Shirley
Daniel Shively
Jerry Shodall
Frank Sholey
Ken Shonk
Robert Shook
Ann Shores
Richard Shores
Shane Shradley
Richard Shreves
Leonard Shrewsbury
Duane Shroufe
Chuck Shultz
Susie Siedentop
Florence Sigsalees
Jack Sikorski
G. Silliman
Arnold Silverman
Alan Silverstein
Edward Simi
Gloria Simms
Richard Simon
Grant Simonds
Gregg Simonds
Roxane & Paul Simonian
Clifford Simonsen
Herva Simpson
Tom Simpson
Dave Simpson
Laura Sims
L. Sims
Patricia Sims
Ronald Singer
Jerry Sisk
Paul Sisson
Daniel Sivertson
Laura Skarr
Larry Skaggs
Waine Skidmore
Robert Skinner
Michael Skowera
Walter Slack
Jeff & Susan Sloss
Donald Slater
Dennis Slates
Steve Slaven
Kermit & Karen Small
Jerry Smalling
William Smart
Steve Smerud
David Smith
Duane Smith
Sally Smith
Sharon Smith
Steve Smith
Susan Smith
Judith Smith
Willis Smith
George Smith
Gregory Smith
Vance Smith
Edgar Smith
Craig Smith
Dorothy Smith
Jeff Smith
Joan & Tim Smith
Kelly Smith
Michael Smith
Nathan Smith
Dan Smith
Donald Smith
E. Smith
Billy Smith
Troy Smith
Laura Smith
Connie Smith
Charlie & Tanya Smith
Geoffrey Smith
William & Sandra Smith
Wilford Smith
Jim Smithson
E J Sneed
Timothy Snider
Bill Snoddy
Charles Snow
Scott Soderstrom
Brenda Sohns
Victor Soltan
N G Somma
Thomas Somandres
Aubert Sonheim
Glen Sonnabend
Jerry Sorensen
Ford Sorenson
Sam Sorich
James Southworth
Vance Spalding
Hal Spander
Bob Speaker
Jay Spehar
Peter Spencer
Roger Spencer
Susan Spencer
David Sperling
Andrew Speth
Tim Speyer
John Spezia
Richard Spotts
Nancy Spraggins
Henrietta Squirewell
Jeff Stabnow
Dennis Stacey
Donald Stacey
George Stack
Stacy
Dennis Stacy
Alan Stahler
Colleen Staley
Mykie Stanford
Ronald Stanford
R. Stanley
John Stansberry
Dee Stapp
Gordon Steele
Robert Steele
Todd Steele
Mark Steen
David Steinle
Donald Stein
Roger Steininger
Mary Stellerini
Don Stenten
Don Stester
Bob Stevens
Tammy Stevens
Bud Stevenson
John Stewart
Donald Stewart
Bruce Stewart
Faye Stewart
Walter Stewart
Roy Stiemmler
Don Stillwell
Eric Stimson
Jim Stinnett
Allen Stinson
Patricia Stockdill
Rob Stokes
Will Stokes
Leslie Stoltz
Ava Stone
Barton Stone
Jon Stone
S W Stone
Ray Storey
James Straight
Steve Stratton
Emilie Strauss
George Strauss
Dan Streeter
Edmond Strickland
Jack Strobel
Eric Strubsacker
Debra Strubsacker
Mary Anne Stroyk
John Stroyk
Mark Stuart
Scott Stumbaugh
Mark Sturck
Tim Sullen
Sean Sullivan
Jeanne Sullivan
Giri Sumen
Steve Sutherland
Russell Swan
Joseph Swaner
Trefy Swaner
John Swanson
Gregory Sweeney
Tim Swendseid
Raymond Swenson
Larry Swett
Gregor Swinderski
Harry Switzer, Sr.
Mary Sykes
Fife Symington
Bill Szymanski
Ed Szyslowski
Marilyn Taber
Ken Tabor
Steve Tabor
Van Talley
Paul Tallman
Mary Tamplin
John Tanaka
Dale Tash
Susan & Russell Tasker
John Taule
Kenneth Taylor
R. Taylor
Jane Taylor
Jack Taylor
Paul Tedesco
Derrick Teel
James Teeter
James Tenney
Daniel Terrazas
Bill Terry
Bob & Phyllis Terry
Wolfe Terry
Wanda Thees
Candace Thomas
Frances Thomas
Frank Thomas
Richard Thomas
Scott Thomas
Robert Thomason
Clifford Thompson
Jan & Donald Thompson
Robert Thompson
Allene Thompson
Ronald Thompson
T Thompson
Don Thompson
Doug Thompson
Tommy Thompson
Leslie Thompson
James Thompson
Amy Thompson
Jack Thornborrow
D G Thurman
Stephanie Tidwell
Charles Tiernan
William Tilden
Jules Tileston
Peg & Julie Tileston
Lorraine Timberlake
Kerri Timmer
Ed Tobin
Chris Tollefson
Selma Tomich
Tom Tomlinson
Alfred Tomlinson
Noel Tomlinson III
Thomas Toole
Robert Toporowski
Harm Toren
Phyllis Torson
Istvan Toth
Patrick Traphagen
Richard Travis
Joan Travostino
Arthur Treeholme
Richard Treeholme
Larry Trent
Everett Tribbett
Marc Trimmer
Larie Trippet
Ruth Troetschler
Tom Troutman
Ross Trujillo

344

Appendix B: Recipients of the Final EIS

Bob Tucker
Crystal Tune
Hugo Tureck
Larry Turk
Charles Turner
Jay Tutchton
William Tweedell
Margaret Tweedy
Carl Twissleman
Tobi Tyler
Robin Tyner
Duane Tyree
Francesca Tyrnauer
Charle Ucker
Chris Udall
Stewart Udall
Barbara Ulliam
Brian Ulm
John Unger
Steve Upton
Robert Uram
Allan Vail
Trudy Valles
James Van Arsdale
Robert Van Camp
Nancy Van De Linde
David Van Den Berg
Rob Van Kirk
Thomas Van Norman
Mary Lois Van Sooy
Mel Van Zeban
Hohn Varnum
Michael Varvis
Wallace Vaux
Lisa Vehman
Albert Velasco
Gil Venable
Jack Venezio
John Venus
Stefan Verchinski
Charleen Verkaik
John Vezina
Terry Viehrberg
Joel Vignere
Peter Vikre
Robert Villalobos
Joseph Villescas
Joanne Vinton
Dennis Visher
Andrew Visocan
Craig Visser
Richard Voit
George Volker
Greg Von Savyoe
Linda Vonflatern
Robert Vrooman
Allen Waggoner
Darrell Wagner
Lew Wagoner
Donald Wagstaff
Nancy Wainwright
Robert Walish
Robert Walk
David Walker
J R Walker
Jana Walker
John Walker
Michael Walker
Randall Walker
Leonard Wall
Stephen Wallace
Rob Walline
Stewart Wallis
Stuart Wallis
A. Walsh
Gary Walter
Donald Walter
Marnie Walters
Jim Walton
Phillip Waner
Larry Wanger
Sylvia Ward
H. Ware, III
Joseph Wargo
Priscilla Warner
Scott Warner
Kenneth Warren
Chuck Washburn
Rebecca Watson
Kent Watson
Vicki Watson
David Watson
Frances Watson-Werner
Gary Watt
George Watt
Mack Watts
Marvin Watts
Edgar Wayburn
Michael Wearne
Lewis Weaver
M. Weaver
Dan Weaver
W. Weber
Rebecca Wechsler
George Weeks
Hal Weeks
Bill Wehde
Donald & Debbie Wehrs
Don Weilmunster
Randy Weimer
Bonita Weimer
Warren Weinel
M. Weiskopf
Steven Weiss
Corinne Mae Welch
Leigh Welig
Reba Wells-Grandrud
Bill Welsh
Frank Welsh
John Welsh
Scott Wentz
John Werden
Frances Werner-Watson
Chris West
Dan West
Jayne West
Thomas West
Larry West
Mel West
Sherry West
Gary Westerlund
David Westphal
Virginia Westphal
Richard Wetzel
James Wharff
Frank Wheat
Pat Wheeler
Richard Wheeler
Floyd Wheelwright
Lyle Wheelwright
Arthur Whener
Howard Whitaker
Ermin & Sally Whittaker
Rohm Whitaker
R. White
Jeffrey White
Dale White
Dick White
Virgil White
Craig Whitesides
W. Whitford, C.E.M.
Kathy Whitman
James Whittaker
Loren Whittermore
Mike Whittington
Bill Wichers
Pat Widder
Barbara Wiggins
Brad Wigglesworth
Mike Wignot
Howard Wiig
Bill Wilans
John Wild
Ruth Wiley
Paul Wilkerson
Ford Wilkinson
Fred Wilkinson
John Wilkus
Ron Willden
Ann Willerton
Linda Williams
Dennis Williams
Eric Williams
Steve Williams
Terry Williams
Kirk Williams
Dan Williams
Rick Williams
Maurice Williamson
Jeff Williamson
Clyde Williamson
Mike Williford
Frederick Willis
Dennis Willis
Robert Wills
D. Wilmarth
Cy Wilsey
Nicole Wilsey
Howard Wilshire
H. Wilshire
R. Wilson
Richard Wilson
Jim Wilson
William Wilson
Walter Wilson
Ken Wilson
Michael Winchester
Patricia Winer
Rachel Winer
Eric Wingerter
Fraxanne Winkie
Jay Winrod
Nancy Winslow
Jean Winterfelt
Thomas Wirtz
Holly Wise
Ron & Mimsi Wise
Marilyn Witt
W R Witt
Pam Witted
Ted Witton
Robert Witzeman
Clark Wockner
Patricia Wolf
Dan Wolfe
Steve Wolff
Eric Wollard
Nora Wolthers
Bob Wood
Janet Wood
John Wood
Joel Wood
Lisa Wood
Gary Woodmansee
Arloa Woolford
Charles Wooten
George Wooten
Shannon Work
Jill Workman
Chuck Worley
Chris & Jenny Worth
Nancy Wotruba
William Wray
Larry Wright
Lisa Wright
Andrew Wright
Brett Wright
Carroll Wright
Jeff Wright
John Wright
Mary Wright
M L Wright
Robert Wright
William Wright
Bryan Wyberg
Craig Wycoff
Glen Wyman
John Wynn
Philip Yadanza
Lih-An Yang
Duane Yantorno
Douglas Yates
Lawrence Yearsley
Michael Yochim
Bill Yoder
Robert Yohe
Russell Yonkers
Naim Younan
Allen Young
John Young
Roland Young
Doug Young
Carl & Curt Youngberg
Tom Youngren

345

Jim Younker
Berta Youtie
Diane Yupe
Cathy Zabloudil
Danielle Zabloudil
Hal Zabriskie
Kiley Zacharias
Peter Zagar
Jim Zahradnicek
John Zamar
Frank Zarate
Donald Zastrow
Janice Zilko
Bob Zimmerman
Janet Zimmerman
John Zimmermann
James Zink
Ruth Zirkle
Fred Zoerner
Shane & Debrorah Zufelt
Fred Zumwalt
Jose Zuniga

APPENDIX C
OTHER APPLICABLE REQUIREMENTS

The following is a list and brief description of major laws, regulations, executive orders, permits, licenses, and reviews that could apply to mineral projects on public lands. This is not intended to be an exhaustive list, and other requirements may apply at the local, county, or state level. Some of the procedural requirements depend upon whether there is an underlying federal action or decision and may not apply under some alternatives, such as Alternative 2, where there is not a BLM decision on specific exploration or mining projects.

CONTENTS

General Requirements A-39
Air Quality A-39
Hazardous Materials and Waste Management A-41
Water Resources A-42
Cultural Resources A-44
American Indian Consultation and Coordination A-47
Cave Resources A-47
Fish and Wildlife Resources A-47
Wild Horses and Burros A-49
Plants A-49
Special Status Areas A-49

GENERAL REQUIREMENTS

The following acts and executive order establish general review requirements or management objectives that apply to mineral projects on public lands.

Federal Land Policy and Management Act of 1976 (FLPMA), P.L. 94-579. Section 302(b) states that "In managing the public lands the Secretary shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands."

Executive Order 12088 - Federal Compliance with Pollution Control Standards, October 13, 1978. Executive Order 12088 directs executive agencies to take all necessary actions to prevent, control, and abate environmental pollution from activities and facilities under their control. This order further directs those agencies to comply, to the same extent as any other person is required to do so, with both the procedural and substantive requirements of pollution control standards, including the Resource Conservation and Recovery Act; Comprehensive Environmental Response, Compensation, and Liability Act; Clean Water Act; Safe Drinking Water Act; and state and local laws and rules.

National Environmental Policy Act of 1969 (NEPA), P.L. 91-190. The National Environmental Policy Act directs federal agencies to consider the environmental impact of their decisions. NEPA requires BLM to prepare environmental assessments or environmental impact statements for the approval of Plans of Operations. Some states, such as Montana and California, have state laws similar to NEPA.

The 1970 Mining and Mineral Policy Act and **The 1980 Natural Materials and Minerals Policy, Research, and Development Act.** Both of these acts direct that the public lands be managed in a manner that recognizes the Nation's need for a domestic source of mineral production.

AIR QUALITY

The federal statutes pertaining to air quality protection are contained in the following acts.

Clean Air Act (CAA), P.L. 84-159 (Air Pollution Control Act; July 14, 1955), 42 USC 7401 et seq., as amended numerous times.

The objectives of the Clean Air Act are (1) to protect and enhance the quality of the Nation's air resources so as to promote the public health, welfare, and productive capacity of its people, (2) to initiate and accelerate a national research and development program to prevent and control air pollution, (3) to provide technical and financial assistance to state and local governments for developing and executing air pollution prevention and control programs, and (4) to encourage and assist the development and operation of regional air pollution prevention and control programs.

The U.S. Environmental Protection Agency (EPA) is responsible for developing standards, rules, guidance, and program oversight. The states have the primary responsibility for enforcing air quality regulations and standards as defined in an EPA-approved "state implementation plan," and may establish more stringent regulations and standards. These responsibilities may be further delegated to local authorities. Tribal governments are responsible for enforcing standards on their lands, based on EPA-approved "tribal implementation plans." BLM is responsible for assuring that all of its activities (either directly or through use authorizations) comply with all local, state, tribal, and federal air quality laws, regulations, and standards.

Specifically, under Section 118 of the Clean Air Act, BLM "(1) having jurisdiction over any property or facility, or (2) engaged in any activity ... which may result in the discharge of air pollutants," and each employee "shall be subject to, and comply with, all Federal, State, interstate, and local [air quality] requirements." These regulations apply to any action (whether substantive or procedural), to requirements to pay fees, to the exercise of any administrative authority, and to any process or sanction. In addition, these requirements apply "not withstanding any immunity of such agencies, officers, agents, or employees under any rule of law."

In addition, under Section 176, BLM "shall not engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to an implementation plan..." Further, "The assurance of conformity to such an implementation plan shall be the affirmative responsibility of the head of such department, agency, or instrumentality." In essence, BLM must demonstrate that every decision or action it takes will comply with air quality requirements.

Federal Land Policy and Management Act of 1976 (FLPMA), P.L. 94-579 (October 21, 1976), 43 USC 1701 et seq., as amended.

An Act; "to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development, and enhancement of the public land; and for other purposes."

Through the Secretary of the Interior, BLM is responsible for implementing FLPMA. As an "organic" act, FLPMA defines BLM's organization and provides the basic policy guidance for management of the Public Lands. Therefore, FLPMA is the primary law guiding all BLM activities; BLM should implement other legislation in a manner that conforms to FLPMA and its overall intent.

As stated in Section 102: "The Congress declares that it is the policy of the United States that ... the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use ..."

Land use plans (Section 202), which describe how the BLM will manage the public lands, must "... provide for compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standards or implementation plans ..."

A provision for revoking or suspending land use, occupancy, or development authorizations upon "a finding of a violation of ... applicable State of Federal air or water quality standard or implementation plan ..." is required under Section 302.

Finally, under Section 505, "each right-of-way [provision] shall ... require compliance with applicable air and water quality standards established by ... Federal or State law ..."

HAZARDOUS MATERIALS AND WASTE MANAGEMENT

Resource Conservation and Recovery Act (RCRA), P.L. 94-580, as amended by the Solid Waste Disposal Act Amendments of 1980, P.L. 96-482, USC 6901 et seq. The Resource Conservation and Recovery Act (RCRA) is the federal law governing management of solid and hazardous waste. RCRA divides wastes on two regulatory tracks: Subtitle D (solid waste) and Subtitle C (hazardous waste). In October 1980 Congress amended RCRA by adding Section 3001(b)(3)(A)(iii) (known as the Bevill exclusion or amendment) for solid waste from the extraction, beneficiation, and processing of ores and minerals. The Bevill amendment excluded such mining waste from regulation as hazardous waste under Subtitle C of RCRA, pending completion of a study and report to Congress. All extraction and beneficiation wastes and 20 special mineral processing wastes are excluded from RCRA Subtitle C regulation by virtue of the Bevill amendment (see 40 CFR 261.4(b)(7)).

RCRA emphasizes the primary role of the states in managing both conventional solid wastes and hazardous wastes. The legislation provided a federal support role with minimal enforcement and regulatory process for conventional solid wastes. Actual regulation and enforcement of solid-nonhazardous wastes was left to the states, which were to follow broad guidelines established at the federal level.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 42 USC 9601 *et seq.*; as amended by Superfund Amendments and Reauthorization Act (SARA), P. L. 99-499, October 17, 1986. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the amendment of the Superfund Amendments and Reauthorization Act (SARA) authorized response to releases or threatened releases of hazardous substances that may endanger public health, welfare, or the environment. The law outlines the procedures for reporting any environmental releases of a hazardous substance that exceeds a reportable quantity and also incudes provisions for permanent cleanups, known as remedial actions, and other cleanups referred to as removals. SARA created the Emergency Planning and Community Right-to-Know Act (EPCRA), a statute designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans by state and local governments.

Uranium Mill Tailings Remediation and Control Act of 1978 (UMTRCA), P.L. 95-604, Nov. 8, 1978; 92 stat. 3021; as amended by P.L. 95-106 , Nov. 9, 1979, 93 stat. 799; and P.L. 97-415, January 4, 1983, 96 stat. 2078. The Uranium Mill Tailings Radiation Control Act (UMTRCA) regulates mill tailings at active and inactive uranium mills that present a hazard to public health. The act provides that efforts must be made to stabilize, control, and dispose of uranium mill tailings in an environmentally sound and safe manner. UMTRCA provides (1) a program of assessment and remedial action at abandoned mill sites and (2) a program regulating mill tailings during processing at active processing mills.

Toxic Release Inventory. The Toxic Release Inventory (TRI), is mandated by a provision of the Emergency Planning and Community Right to Know Act (EPCRA), which requires specified industries to report releases of more than 650 chemicals and chemical categories to air, land, and water. The TRI's purpose is to give citizens information about chemicals being used, processed, manufactured or released from facilities in their communities. As of 1999, mining was added to the groups of industries that need to report under TRI.

If a mining company has a certain number of employees and chemicals, it must report any releases. The process is a paperwork exercise to determine the amount of certain chemicals that are placed on the land, air, and water. For example, a mining operator must determine how much arsenic is in waste rock and state how much the release is. But the report does not state how much of the material is available to the environment. A chemical plant that spills 200 gallons of arsenic has a problem, whereas a mine that produces 200 tons of waste rock with arsenic may not have a problem unless the arsenic is mobilized.

WATER RESOURCES

Clean Water Act (CWA), P.L. 92-500, as amended by P.L. 95-217, P.L. 95-576, P.L. 96-483, and P.L. 97-117; 33 USC 125. et seg. The objectives of the Clean Water Act are to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The act protects surface "navigable" water through federally enforceable regulations, with emphasis on discharge of pollutants to surface waters.

Regulations for protecting ground water are not specifically included in the Clean Water Act. Authority to protect ground water is vested in the states. But the Clean Water Act clearly delineates the federal role in protecting ground water quality. Section 313 requires federal compliance with valid state and local government requirements to the same extent as any nongovernmental entity. Sections 208 and 106 provide the federal financial assistance and guidance to state and local governments for planning and managing ground water resources. Section 208b.2 requires that individual states develop processes to identify and control the following:

> Surface mining and underground mining-associated pollution of surface water and ground water.

Intrusion of salt water into fresh ground water aquifers.

The disposition of residual wastes that could degrade the quality of surface or ground water.

The disposal of pollutants on land or in excavations wherein adjacent surface water or ground water quality degradation could ultimately result.

The Clean Water Act also regulates dredge and fill placement in waters of the United States. A permit under Section 404 of the act is required for mining that would disturb wetlands or other waters of the United States. This permitting program is administered by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency.

Safe Drinking Water Act (SDWA), P.L. 93-523, as amended by P.L. 95-190, 42 USC 300 et seq. In 1974 Congress passed the Safe Drinking Water Act, part C of which directed the Environmental Protection Agency to establish minimum requirements for effective state programs to prevent underground injection that endangers ground water resources of public supply systems. This program became known as the Underground Injection Control Program (UIC).

Under the Undergrou[illegible] Injection Control Program injection wells are divided into five well classes for the purpose of regulations. Class III wells are used to inject fluids for the recovery of minerals such as solution mining of salts and sulfur and in-situ leaching of uranium, copper, or (experimentally so far) gold. Class V wells and for a while some class I wells have mining application for the disposal of hazardous or nonhazardous waste, including the use of mine wastes to backfill underground mines.

The purpose of the Safe Drinking Water Act is to protect the public health and welfare by assuring that the quality of drinking water provided by public water systems is adequate for human use. To meet this goal, the act provides for the following:

Establishing primary national drinking water regulations setting forth mandatory maximum contaminant levels in drinking water supplied by public water systems.

Establishing secondary national drinking water regulations for public water systems. These regulations are not mandatory, but they are recommended standards to protect public health.

Protecting the quality of aquifers that serve as the main source of drinking water for an area and that, if contaminated, would create a significant public health hazard.

Protecting underground sources of drinking water from injection of pollutants.

The Safe Drinking Water Act provides for and encourages delegation of its authorities to the states, which assume primary responsibility for enforcing its provisions. Only if a state fails to assume the responsibility would EPA assume enforcement responsibility.

Under the provisions of Section 1447(a) of the act, BLM is required to comply with both the substantive and procedural requirements of the act. Specifically, Section 1447 directs that

> (a) Each federal agency (1) having jurisdiction over any federally owned or maintained public water system or (2) engaged in any activity that results in or may result in underground injection that endangers drinking water (within the meaning of Section 1421(d)(2)) is subject to and must comply with all federal, state, and local requirements; administrative authorities; and processes and sanctions respecting the provision of safe drinking water and respecting any underground injection program in the same manner, and to the same extent, as any nongovernmental entity.

Under the provisions of the act, BLM therefore is not responsible for primary enforcement of the act's requirements but rather is regulated by those provisions. BLM's role is to help the states in their efforts to protect the quality of ground water that has present or potential use as an underground source of drinking water.

Wild and Scenic Rivers Act, P.L. 90-548, Oct. 2, 1968, 82 stat. 906 and as amended. Portions of this act provide for control of activities that are on land next to rivers and could cause or contribute to pollution of waters, or could degrade water quality through erosion and siltation of riverbank lands, and contamination of ground water sources feeding the river.

Executive Order 11990, Protection of Wetlands, May 24, 1977, 44 FR 1955. Executive Order 11990 directs all agencies to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands according to the National Environmental Policy Act. The order covers aspects of federal activities affecting wetlands, including land management, facilities development, and licensing regulations. Agencies are asked to minimize the impacts of federal actions on wetlands and their related beneficial effects, such as ground water recharge. In carrying out any activities affecting wetlands, federal agencies must consider such factors as public health, safety, and, welfare, including such things as water supply and quality, recharge, and discharge areas for ground water, pollution, etc.

CULTURAL RESOURCES

Antiquities Act of 1906 (P.L. 59-209): The Antiquities Act provides for the protection of archaeological resources on Federal lands through criminal sanctions against excavation, injury, or destruction of archaeological sites without permission. This legislation has been declared unconstitutionally vague in the Ninth Circuit and is no longer enforced. Enforcement problems with The Antiquities Act led to the other Federal historic preservation laws.

National Historic Preservation Act of 1966 (P.L. 89-665 as amended by P.L. 94-422, P.L. 94-458, and P.L. 96-515): The National Historic Preservation Act is the basic federal mandate for managing and protecting historic properties, Section 106 requires federal agencies to account for the effects of their actions on historic properties on public and private lands. It allows the public, the State Historic Preservation Officer and the President's Advisory Council on Historic Preservation to comment on federal undertakings before authorization. Section 110 requires agencies to systematically inventory all lands for historic properties and protect them through active management. Section 106 compliance has dominated the program whereas Section 110 has largely been ignored. Amendments enacted in 1992 direct agencies to account for the effects of proposed activities on traditional cultural properties associated with Native Americans, ranching communities, and other traditional lifeways. This law is implemented at 36 Code of Federal Regulations 800 which has been revised in response to the 1992 amendment. The revision, completed in July of 1999, more directly involves Tribal Historic Preservation Officers in the determination of significant Traditional Cultural Places and the affects that Federal actions may have upon them.

The National Register aspects of the National Historic Preservation Act are implemented at 36 Code of Federal Regulations 60, 63, and 68. BLM Manuals 8111 - *Cultural Resources Inventory and Evaluation (Upland)*, 8141 - *Physical and Administrative Protection Measures*, and 8143 - *Procedures for the Avoidance or Mitigation of Effects on Cultural Resources* further implement the National Historic Preservation Act. The new regulations have not been incorporated into manual sections to date.

American Indian Religious Freedom Act of 1978 (P.L. 95-341): The American Indian Religious Freedom Act requires federal agencies to consider the effect of their policies on Native American traditional beliefs. Although the American Indian Religious Freedom Act has no implementing regulations and has not been enforced, it is of great political and cultural significance to Native Americans. The Federal Government's failure to enforce American Indian Religious Freedom Act has resulted in more stringent Native American legislation. Bureau of Land Management Manual 8161 - *Native American Consultation* addresses the intent of American Indian Religious Freedom Act.

Native American Graves Protection and Repatriation Act (P.L. 101-106) The Native American Graves Protection and Repatriation Act pertains to Native American human remains, funerary items, sacred objects, and items of cultural patrimony removed from public lands. This law has two major provisions. The first vests ownership of Native American Graves Protection and Repatriation Act items with Native Americans and requires agencies to consult with Native Americans to repatriate them. The second requires ongoing consultation and coordination with Native Americans about discoveries of Native American Graves Protection and Repatriation Act items during activities on public lands. We are consulting with Native Americans on a project-specific basis and are working with tribal governments to draft memoranda of understanding dealing programmatically with discoveries. Native American Graves Protection and Repatriation Act regulations are being written. BLM Manual 8161 and its consultation handbook provide guidance for BLM consultation.

Archaeological Resources Protection Act of 1979 (P.L. 96-96): The Archaeological Resources Protection Act requires a permit for any excavation or removal of archaeological resources from public lands and provides civil and criminal penalties for violation of permit requirements. Given these penalties, ARPA is the basis for most prosecutions and suits involving archaeological resources. It also provides the mandate for the Cultural Resources Use Permit System, as well as archaeological resource interpretive and education programs. ARPA also requires the systematic inventory of all federal lands to find and protect archaeological resources. ARPA is implemented at 36 Code of Federal Regulations 296: 43 Code of Federal Regulations 3 and 7 and in Bureau of Land Management Manual 8151 - *Cultural Resource Use Permits*.

National Environmental Policy Act of 1969 (P.L. 91-190): The National Environmental Policy Act directs federal agencies to consider cultural resources in fostering environmental quality and preservation of important historic, cultural and natural aspects of our national resources. National Environmental Policy Act documentation routinely considers impacts to cultural and paleontological resources. BLM Manual 8130 - *Cultural Resources Planning* further clarifies and implements the cultural resources aspects of National Environmental Policy Act.

Federal Land Policy and Management Act of 1976 (P.L. 94-579): The Federal Land Policy and Management Act directs BLM to inventory cultural resources and to protect scientific, historic, and archaeologic resources within the framework of multiple use management. This law is the basis for the paleontological resources management program. The act also requires coordination of BLM land use programs "of and for" Indian tribes by considering the policies of approved state and federally recognized tribal land resource management programs in land use planning. BLM Manual 8100 - *Cultural Resources Management* implements the cultural resources aspects of FLPMA.

Executive Order 11593: This order supplements the National Historic Preservation Act and Archaeological Resources Protection Act by directing federal agencies to locate and inventory all cultural resources under their jurisdiction and to ensure that actions do not affect significant cultural resources. It also directs agencies to consider the effects of their actions on nonfederal lands. No direct implementing regulations or policies have been developed for this order.

Executive Order 94-3175: This order directs federal agencies to deal with Native American tribal governments on a government-to-government basis and to pay special attention to federal Indian trust responsibilities. Since this is a new order, no specific implementing policies are in place, and its implications for land management are being worked out in the field.

Additional Regulations: Requirements for managing archaeological collections and other museum property are at 36 Code of Federal Regulations 79. These regulations require a significant new workload to inventory and properly curate museum property and collections. Other than minimal training, BLM Nevada does not have the staff expertise to comply with this regulation.

AMERICAN INDIAN CONSULTATION AND COORDINATION

Executive Order 13084: Executive Order 13084, signed May 14, 1998, requires "regular and meaningful consultation and collaboration with Indian tribal governments in developing regulatory practices on federal matters that significantly or uniquely affect their communities; to reduce the imposition of unfunded mandates upon Indian tribal governments; and to streamline the application process for and increase the availability of waivers to Indian tribal governments".

The American Indian Religious Freedom Act of 1978 and Executive Order 13007: This act and order require federal agencies to evaluate their policies and procedures to protect the religious freedom of Native Americans. In American Indian religious practice, any geographic area can contain specific places that are significant for sacred practices or purposes. Those sacred places embodying spiritual values may contain specific land forms, indigenous rock art, medicine wheels, rock cairns and effigy figures, spirit trails and spirit gates, caves, springs or lakes., Indian graves, or contemporary use areas.

CAVE RESOURCES

The Federal Cave Resources Protection Act of 1988 (FCRPA) provides for the designation of significance by six criteria: biota, cultural, geologic/mineralogic/paleontologic, hydrologic, recreational, and educational or scientific values. Upon discovery, the cave is evaluated to determine its significance. If a cave is determined to be significant, its entire extent, including passages not mapped or discovered at the time of determination, is deemed significant.

FISH AND WILDLIFE RESOURCES

Although a variety of laws, regulations, policies, and programs relate to wildlife, the following have a major affect on the protection of wildlife resources in relation to mining.

The Endangered Species Act, P.L. 93-205 (1973), P.L. 94-359 (1974), P.L. 95-212 (1977), P.L. 95-632 (1978), P.L. 96-159 (1979), P.L. 97-304 (1982), P.L. 100-653 (1988). The purpose of this act is to identify and conserve species that are threatened or endangered with extinction. The act prohibits the taking of species listed as threatened or endangered, either directly or indirectly through habitat loss or modification. This prohibition applies to all activities regardless of land ownership.

Migratory Bird Treaty Act, P.L. 86-732 (1960). This act is an international treaty that prohibits the taking of any migratory bird without permit or authorization. This prohibition applies to situations where, for example, migratory waterfowl land on a tailings pond or process solution pond that contains toxic levels of contaminants. Any resulting wildlife deaths would be

356

(and have been) violations of the Migratory Bird Treaty Act. This prohibition applies to all activities regardless of land ownership.

Fish and Wildlife Coordination Act, 16 U.S.C. 661-667e, March 10, 1934, as amended 1946, 1958, 1978 and 1995. This act's purposes are to recognize the vital contribution of our wildlife resources to the Nation, and their increasing public interest and significance, and to provide that wildlife conservation receive equal consideration and be coordinated with other features of water-resource development programs through planning, development, maintenance, and coordination of wildlife conservation and rehabilitation. In furtherance of the stated purposes, the Secretary of the Interior is authorized to provide assistance to, and cooperate with, federal, state, and public or private agencies and organizations in developing, protecting, rearing, and stocking all species of wildlife, resources thereof, and their habitat; controlling losses from disease or other causes; minimizing damages from overabundant species; providing public shooting and fishing areas, including easements across public lands; carrying out other necessary measures. The Secretary is also authorized to make surveys and investigations of the wildlife of the public domain, including lands and waters or interest acquired or controlled by an agency of the United States and to accept donations of land and contributions of funds in furtherance of the purposes of this act.

Executive Order 13112, Invasive Species, February 3, 1999. Executive Order 13112 directs all agencies to take action to prevent the introduction of invasive species, detect and control invasive species populations, monitor invasive species, provide for restoration of native species, conduct research on invasive species and develop technologies to prevent the introduction of invasive species, and promote public education.

Bald Eagle Act of 1940, as amended by P.L. 92-535 (1972). This act protects the bald eagle and golden eagle by prohibiting except under certain specified conditions the taking, possession, and commerce of such birds.

Sustainable Fisheries Act (Public Law 104-297) (1996). Among other things, this act amended the habitat provisions of the Magnuson Act. The renamed Magnuson-Stevens Act calls for direct action to stop or reverse the continued loss of fish habitats. Toward this end, Congress mandated (1) the identification of habitats essential to managed species (essential fish habitat) and (2) measures to conserve and enhance this habitat. The act requires federal agencies to consult with the Secretary of Commerce on any activity or proposed activity authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat. On BLM managed public lands, essential fish habitat refers to those waters and substrate necessary to salmon for spawning, breeding, feeding, or growth to maturity (Magnuson-Stevens Act, 16 U.S.C. 1801 et seq). The following definitions (EFH Interim Final Rule, 62 FR 66531) interpret the meaning of essential fish habitat:

> **Waters** include aquatic areas and their associated physical, chemical, and biological properties that are used by salmon and may include aquatic areas historically used by salmon where appropriate.

Substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities.

Necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and spawning, breeding, feeding, or growth to maturity covers a species' full life cycle.

WILD HORSES AND BURROS

Wild Free-Roaming Horses and Burros Act of 1971, P.L. 92-195, as amended by P.L. 94-579 (1976) and P.L. 95-514 (1978). This act protects wild free-roaming horses and burros, directing BLM and the Forest Service to manage such animals on public lands under their jurisdiction.

PLANTS

Executive Order 13148, Greening the Government Through Leadership in Environmental Management, April 22, 2000. This Executive Order directs agencies to incorporate regionally native plants in site design and implementation where cost-effective and to the maximum extent practicable on all Federal projects or federally-funded projects.

SPECIAL STATUS AREAS

Wilderness Act (16 U.S.C. 1131-1136) § 1133. Use of wilderness areas 43 CFR Ch. II Subpart 8560-(b) ... wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use. The objective of these regulations is to manage the public lands designated as part of the National Wilderness Preservation System to preserve and protect their wilderness character, provide for their use and enjoyment by the American people in a manner that will leave them unimpaired for future use and enjoyment as wilderness, and allow for recreational, scenic, scientific, educational, conservation, and historical use. Subpart 8560.4-6 describes mining law administration in wilderness areas. These regulations require that mineral operations be conducted to maintain the wilderness character unimpaired consistent with the use of the land for mineral activities and that all facilities must be removed within 1 year after operations cease. This section also requires that validity examinations be conducted before allowing mining operations in wilderness areas to determine if valid existing rights were present as of the date of withdrawal.

Research Natural Areas, 43 CFR Subpart 8223. No person shall use, occupy, construct, or maintain facilities in a research natural area except as permitted by law, other federal regulations, or authorized under provisions of this subpart 8223.

(b) No person shall use, occupy, construct, or maintain facilities in a manner inconsistent with the purpose of the research natural area.

(c) Scientists and educators shall use the area in a manner that is nondestructive and consistent with the purpose of the research natural area.

APPENDIX D
MINING REGULATORY PROGRAMS IN THE WESTERN UNITED STATES

Appendix D of the draft EIS provided a discussion of the state mining regulation programs. The appendix was presented as a summary of the programs. We did not present a more detailed discussion because the state regulatory programs would exist under all alternatives. We felt that such a detailed discussion of the state regulatory provisions would not measurably change the analysis of the programmatic differences between the alternatives

But we received extensive comments on the inadequacies of our presentation due to a lack of a comprehensive review of the state programs. As part of their comments on the draft EIS, the Precious Metals Producers submitted a detailed review of state regulatory programs. In addition, the review correlated the existing state requirements with the February 9, 1999 proposed provisions. This document was an update of a 1994 survey conducted by the Precious Metals Produces of the western state mining regulations, including the regulatory requirements for Alaska, Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming. Because we found the Precious Metal Producers document to be both comprehensive and accurate, we feel it is suitable to include their complete review in its entirety as submitted in their February 23, 2000 comment letter in the final EIS.

Our review of the Precious Metal Producers document found at least one point needing clarification. ***The Arizona Mined Land Reclamation Act applies only to metalliferous mines, or mines providing feed to metalliferous mines, on private land. Absent an Memorandum of Understanding or some form of agreement between the BLM and the State of Arizona, the Arizona Mining Land Reclamation Act has no authority on BLM managed lands.***

CONTENTS

Introduction A-54

Alaska A-56

Arizona A-59

California A-64

Colorado A-69

Idaho A-74

Montana A-79

Nevada A-85

New Mexico A-90

Oregon A-95

South Dakota A-99

Utah A-106

Washington A-111

Wyoming A-115

Mining Regulatory Programs in the Western United States
A Survey of State Laws and Regulations

February 23, 2000

prepared for
the Precious Metals Producers

by
Steven G. Barringer
Dickstein, Shapiro, Morin & Oshinsky LLP
2101 L Street NW
Washington, D.C. 20037

362

Introduction

Purpose of the Survey

The Precious Metals Producers[1] (PMP) first conducted a survey of state mining regulatory programs in 1994, as Congress was deliberating proposals to rewrite the Mining Law of 1872. Some critics of the 1872 Mining Law have charged that the environmental impacts of mining are virtually unregulated in the United States, and urged Congress to adopt sweeping new environmental requirements as part of the Mining Law legislation. These critics also maintain that states do not regulate mining, or that state regulatory programs have significant gaps that threaten the environment and that must be remedied by the federal government.

The purpose the original survey was to determine whether and to what extent Western states containing lands open to location under the 1872 Mining Law regulate the mining industry. The 1994 Survey showed that all western states except two – New Mexico and Arizona – required mined lands to be reclaimed. The Survey also showed that all states were at that time extensively regulating environmental impacts to soils, surface water, ground water and air.

Since 1994, Arizona and New Mexico have enacted statutes requiring reclamation, and have been developing implementing regulations. Most other states have made changes and improvements in their laws, and so PMP determined to update the State Law Survey to account for changes and to determine the status of state mining regulatory programs. The scope and adequacy of state regulatory programs remains an important policy issue at the federal level. Congress continues to consider changes to the 1872 Mining Law, and the Department of Interior announced its intention in 1997 to rewrite its own rules governing mining on public lands. State laws and jurisdiction are relevant to both of the efforts, and other federal regulatory initiatives.

Method

We took the same approach to the update as to the original survey. Originally, the categories we surveyed came from 1994 legislative proposals to rewrite the Mining Law, particularly bills introduced in Congress by Rep. Nick Rahall and former Senator Bennett Johnston. This version of the Survey organizes state regulatory authorities using the proposed environmental and operational performance standards found in the BLM's Proposed Rule amending the surface management regulations at 43 C.F.R. § 3809. 64 Fed. Reg. 6421 (February 9, 1999).

We prepared draft surveys by conducting legal research and reviewing state statutes, rules, policy statements and guidance. We conducted numerous conversations with state regulators to learn as much as possible about state regulatory programs, the sources of authority, the responsibilities of each state agency, their coordination with each other and their coordination with federal agencies. We revised the draft surveys to make them as accurate as possible, and then provided them to state regulators for their comments. We incorporated these comments wherever they were offered, and finalized the surveys.

The result, while not perfect, is a fair and objective representation of the state laws that apply to mining operations in the Western United States. While the PMP companies obviously approach regulatory debates from an industry viewpoint, they offer the State Law Survey as a service, hopefully to clarify the status of state programs and to advance a constructive discussion about the role of states in environmental regulation and reclamation, on federal, state-owned and private lands.. The State Law Survey makes its unecessary to rely on broad generalizations or speculation about how states regulate the mining industry.

---

[1] The Precious Metals Producers are: Barrick Goldstrike Mines, Inc., Battle Mountain Gold Company, Echo Bay Mines, and Independence Mining Co.

Observations

There have been many changes and improvements in states' programs since the first PMP State Law Survey. The State of Nevada already had adopted controls on operations using cyanide and other chemical reagents; many states followed this lead since 1994. All states have focused on the environmental threats posed by acid generation, adopting combinations of statutes, rules and policies intended to prevent or control pollution from this phenomenon. Many states have added new or stricter bonding requirements.

States also have responded or are responding to issues that concern them uniquely. As already mentioned, states where precious metals mining is prevalent have regulated the handling, use and control of cyanide (Nevada, Oregon, South Dakota, Washington and Utah). Coastal states are integrating mining regulatory requirements with efforts to protect and manage coastal zone environments and ecosystems.

There certainly are differences in approach, and some states' programs are more advanced than others. However, there are no glaring "gaps" in state programs that demand a federal legislative or regulatory intervention to avoid harm to the environment. States are acting on their own to address environmental threats.

Acknowledgements

To the various representatives of the Western states who gave us comments and guidance and corrected our work, we are very appreciative. It is those contributions that make this Survey useful for everyone interested in the regulation of mining activities on federal lands. Messrs. David Kimball, David Armstrong and Dalva Mollenberg of the firm Gallagher and Kennedy in Phoenix, contributed heavily to the Arizona and New Mexico Surveys. Denise Jones, Jim Good of the firm Gresham, Savage, Nolan & Tilden, and members of the Calfornia Mining Association provided invaluable information in updating the California Survey.

Steven G. Barringer
February 23, 2000

ALASKA

Mining operations, including reclamation activities, are regulated primarily by the Division of Mining Land and Water, in the Alaska Department of Natural Resources (DNR), the Department of Environmental Conservation and the Department of Fish and Game. DNR administers the Alaska reclamation statute, Alaska Stat. §§ 27.19.010 - 100, and implementing regulations, Alaska Admin. Code tit. 11, § 97.100-990. Mining operations without a reclamation plan approved by DNR are prohibited. Alaska Stat. § 27.19.030(a), Alaska Admin. Code tit. 11, § 97.310. Before commencing mining operations, a performance bond must be posted with DNR in an amount sufficient to ensure "the faithful performance of the approved reclamation plan." Alaska Stat. § 27.19.040(a). A mining operation must be conducted in a manner that "prevents unnecessary and undue degradation of land and water resources" and include contemporaneous reclamation. Alaska Stat. § 27.19.020. Mining operations also must comply with the Alaska Environmental Conservation Law, a comprehensive environmental statute that regulates surface and ground water quality, air quality, and solid and hazardous wastes, administered by the Alaska Department of Environmental Conservation (DEC). Alaska Stat. Tit. 46, ch. 3, 14.

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Mining operations must comply with the air quality control provisions of the Alaska Environmental Conservation Act. Alaska Stat. § § 46.14.010 - 990, Alaska Admin. Code tit. 18, ch. 50. DEC issues construction and operating permits for mining operations, including processing facilities that emit air pollutants, including fugitive dust. Alaska Admin. Code tit. 18, § 50.300. Air quality requirements are part of Alaska's State Implementation Plan (SIP) required by the federal Clean Air Act. 42 U.S.C. § 7410.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

A mining operation must be conducted in a manner that "prevents unnecessary and undue degradation" of surface and ground water. Alaska Stat. § 27.19.020. Mining operations must comply with Alaska's antidegradation policy and surface and ground water quality standards. Alaska Admin. Code tit. 18, § 70.010(b).).

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Point source discharges to surface waters from mining operations must have a National Pollution Discharge Elimination System (NPDES) permit issued by the U.S. Environmental Protection Agency. 42 U.S.C. § 1342. Mining operations must comply with Alaska's antidegradation policy and surface water quality standards. Alaska Admin. Code tit. 18, § 70.010(b).

GROUND WATER [*Proposed* 43 CFR 3809.420(B)(2)(ii)]

Mining operations must comply with Alaska's antidegradation policy and ground water quality standards. Alaska Admin. Code tit. 18, § 70.010(b).).

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

A mine operator must reclaim a mined area with the potential to generate acid mine drainage so that acid mine drainage is not generated or is not discharged offsite. Alaska Admin. Code tit. 11, § 97.240.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Alaska must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

If a mining operation diverts a stream channel or modifies a flood plain to the extent that the stream channel is no longer stable, an operator must reestablish the stream channel in a stable location. A settling basin, however, cannot be placed in the way of a reestablished channel location unless the fines will be properly removed or protected from erosion. Alaska Admin. Code tit. 11, § 97.200(d). An operator may not redistribute topsoil or other growth media over surfaces likely to be exposed to annual flooding, unless the action is authorized in an approved reclamation plan and will not result in an unlawful point or nonpoint source discharge of pollutants. Alaska Admin. Code tit. 11, § 97.200(a)(3). Disturbed lands must be returned to a condition that can reasonably be expected to return waterborne soil erosion to pre-mining levels within one year after completion of reclamation. Alaska Admin. Code tit. 11, § 97.200(a)(1).

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

A reclamation plan must detail measures for topsoil removal, storage, protection, and replacement. Alaska Admin. Code tit. 11 § 97.310(b)(6)(A). If topsoil is not promptly redistributed to an area being reclaimed, then the topsoil must be segregated, protected from erosion and contamination by acidic and toxic materials, and preserved in a condition suitable for later use. Alaska Admin. Code tit. 11, § 97.200(a)(2).

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

An operator must take measures to promote natural revegetation, including redistribution of topsoil or other suitable growth media. Alaska Admin. Code tit. 11, § 97.200(a)(3). Mining operations must be left in a "stable condition," Alaska Stat. § 27.19.020, which means "a condition that can reasonably be expected to return waterborne soil erosion to pre-mining levels within one year" after completion of reclamation and "that can reasonably be expected to achieve revegetation, where feasible, within five years after the reclamation is completed, without the need for fertilization or reseeding." Alaska Admin. Code tit. 11, § 97.200(a)(1). An operator must stabilize a reclaimed site to a condition that will retain sufficient moisture for natural revegetation or for an approved alternate post-mining land use. Alaska Admin. Code tit 11, § 97.200(b). Pit walls, subsidence features, or quarry walls are exempt from these requirements if the steepness of the wall make attaining this standard impossible or impracticable; however, the wall must be left in a condition such that it will not collapse or allow loose rock that presents a safety hazard. Alaska Admin. Code tit. 11, § 97.200(c). If the natural composition, texture or porosity of surface materials are not conducive to natural revegetation, a mine operator must take measures to promote natural revegetation, including redistributing topsoil or other suitable growth media. Alaska Admin. Code tit. 11, § 97.200(a)(3).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

The Alaska Department of Fish and Game reviews all proposed reclamation plans and can require a mine operator to obtain a "Title 16" permit if the proposed mining operations will impact fish or wildlife. A Title 16 permit will specify measures an operator must take to protect fish and wildlife. Alaska Stat. § 16.10.020.

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

An operator must remove, dismantle, or otherwise properly dispose of buildings and structures constructed, used, or improved on state land unless the surface owner or manager authorizes the buildings or structures to stay. An operator must remove or otherwise properly dispose of all scrap iron, equipment, tools, piping, hardware, chemicals, fuels, waste and general construction debris on state land. Alaska Admin. Code tit. 11, § 97.210.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

A mine operator must stabilize and properly seal the openings of all shafts, adits, tunnels, and air vents to underground mine workings after mine closure to ensure protection of the public, wildlife, and the environment. Alaska Admin. Code tit. 11, § 97.220.

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

A reclamation plan must detail proposed tailings or spoil disposal areas and contain measures for the reclamation of tailings impoundments, settling ponds, reservoirs, heaps, open pits and cuts, shafts, adits, tunnels, portals, overburden, waste rock storage areas and all other affected areas. Alaska Admin. Code tit. 11, § 97.310(b)(4), (6)(B). After neutralization, an operator must reclaim heaps, pads, ponds, and other such facilities in a manner consistent with requirements imposed by DNR and DEC and the statutory and regulatory provisions of the Alaska reclamation law. Alaska Admin. Code tit. 11, § 97.230.

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

Diverted stream channels must be left in a stable condition. Alaska Admin. Code tit. 11, § 97.200(d). An operator must stabilize and properly seal the openings of all shafts, adits, tunnels, and air vents to underground mine workings after mine closure to ensure protection of the public, wildlife, and the environment. Alaska Admin. Code tit. 11, § 97.220. Disturbed lands must be reclaimed so that the surface contours after reclamation are complete and conducive to natural revegetation or are consistent with an alternative post-mining land use intended by the land owner for mining operations on private land. Measures to accomplish this may include backfilling, contouring, and grading, but an operator need not restore the site's approximate original contour. Alaska Admin. Code tit. 11, § 97.200(b). Disturbed lands must be returned to a condition that can reasonably be expected to return waterborne soil erosion to pre-mining levels within one year after completion of reclamation. Alaska Admin. Code tit. 11, § 97.200(a)(1).

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

An operator must post a performance bond which reflects the reasonable and probable costs of reclamation, not to exceed $750 for each acre of mined area. Alaska Stat. § 27.19.040(a). Alternatively, an operator may participate in a statewide bonding pool for mining operations established by the state. Alaska Stat. § 27.19.040(b). The posting of a performance bond, or participation in the bonding pool, does not limit the department's right to seek further compensation for a violation of Alaska's reclamation statute or the operator's approved reclamation plan. The miner is liable for the full costs of reclamation, regardless of the amount of the reclamation bond or bonding pool deposit and fees. Alaska Admin. Code tit. 11, § 97.430. If a mine operator violates an approved reclamation plan and has failed to comply with an order of DNR, DNR is authorized to cause the forfeiture of the performance bond and use the proceeds to reclaim the site. Alaska Stat. § § 27.19.040(c), 27.19.070(a). A mine operator who has previously forfeited a reclamation bond or been held liable in a civil action must post a reclamation risk assessment fee equal to five times the bond liability for the proposed mining operation. Alaska Stat. § 27.19.070(c).

INSPECTION [*Proposed* 43 CFR 3809.600]

An operator must allow DNR to have access to the mining operation at reasonable times for the purpose of inspecting or monitoring compliance with an approved reclamation plan. Alaska Admin. Code tit. 11, § 97.340(b). The Alaska Environmental Conservation Act authorizes DEC to seek search warrants to investigate actual or suspected sources of pollution or to ascertain compliance with the terms of the Act. Alaska Stat. § 46.03.860.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

DNR may issue a compliance order for violations of the statutory or regulatory provisions of the Alaska reclamation law. Alaska Admin. Code tit. 11, § 97.630. DEC can issue compliance orders under the Alaska Environmental Conservation Act. Alaska Stat. § 46.03.850.

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

DNR may suspend or revoke approval to operate those mining operations not being conducted as required in the approved reclamation plan. Alaska Stat. § 27.19.070(b). DEC can suspend or revoke permits issued under the water quality provisions of the Alaska Environmental Conservation Act, Alaska Stat. § 46.03.120, or air permits. Alaska Stat. § 46.14.280, Alaska Admin. Code tit. 18, ch. 50.

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

An operator who violates the approved reclamation plan and fails to comply with an order of the Commissioner is liable to the state in a civil action for the full amount of reclamation and administrative costs incurred by the state to reclaim. Alaska Stat. § 27.19.070(a). The Alaska Attorney General can recover damages for death to fish, animals, or vegetation, or other injuries that degrade the environment, caused by violations of the Alaska Environmental Conservation Act. Damages equal the costs to restock injured land or waters, to replenish a damaged or degraded resource, or otherwise restore the environment to its condition before the injury. Alaska Stat. § 46.03.780. Other suits for damages are governed by common law. The state may sue to recover natural resources damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. 42 U.S.C. § 9607(f). DNR can seek to have the Attorney General enforce an administrative order suspending or revoking approval to operate. Alaska Admin. Code tit. 11, § 97.630. The Alaska Environmental Conservation Act authorizes DEC to seek injunctions to enjoin violations of the Act. Alaska Stat. § 46.03.765.

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

Alaska's reclamation law does not impose criminal liability. DEC can seek criminal penalties for violations of the Alaska Environmental Conservation Act. Alaska Stat. § 46.03.790.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

DNR may assess judicially enforceable administrative penalties in an amount up to the full amount of reclamation and administrative costs incurred by the state related to the action, for violations of Alaska's reclamation law. Alaska Stat. §27.19.070(a), Alaska Admin. Code tit. 11, § 97.630. DEC can seek civil penalties for violations of the Alaska Environmental Conservation Act, Alaska Stat. § 46.03.760, of not less than $500 nor more than $100,000 for the initial violation, nor more than $5,000 for each day after that.

CITIZEN SUITS [No provision in proposed rule]

Citizen suits are not authorized for violations of Alaska's reclamation law. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

ARIZONA

State environmental and reclamation requirements for mining operations in Arizona are governed primarily by two major programs, the Arizona Environmental Quality Act ("EQA") administered by the Arizona Department of

Environmental Quality ("ADEQ") and the Arizona Mined Land Reclamation Act ("MLRA") administered by the Arizona State Mine inspector ("ASMI"). In addition, the U.S. Environmental Protection Agency ("EPA"), Region IX, administers the federal Clean Water Act NPDES permit program and the U.S. Army Corps of Engineers administers the Clean Water Act section 404 permit program.

The MLRA requires existing and new mining operations and exploration operations to submit and obtain approval of reclamation plans. Reclamation standards are established in the MLRA and implementing rules. The MLRA also requires financial assurance. New mining operations may not begin surface disturbances until ASMI has approved a reclamation plan. Existing mining operations must submit a reclamation plan to ASMI for approval by April 1, 1997.

The EQA established the Aquifer Protection Permit ("APP") Program, which applies to discharging facilities, including surface impoundments, mine tailings piles and ponds, and mine leaching operations. This program requires a permittee to employ the Best Available Demonstrated Control Technology ("BADCT") to achieve the greatest practicable reduction in the amount of discharge and not cause or contribute to a violation of aquifer water quality standards. A.R.S. 5 49-243, A.A.C.R. 18-9-108. The APP program also requires closure plans, post-closure care and a demonstration of financial capability to ensure that closure is conducted in a manner to protect water quality. "Existing facilities," which include discharging facilities in operation before 1986, may continue under either a notice of disposal or groundwater quality protection permit under a predecessor program, as long as they do not cause or contribute to a violation of aquifer water quality standards. A.A.C.R. 18-9-103. ADEQ is under statutory deadlines to complete issuance of APP's to existing facilities. A.R.S. § 49-241.01. To meet these deadlines, the Department has established a schedule for submission of permit applications for existing facilities.

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Air quality standards established pursuant to state and federal law are enforceable through permit programs administered by ADEQ or by some counties. A.R.S. §§ 49-426 and 49-480. Where there is no specific permit covering an operation, ADEQ's air pollution control rules require precautions to be taken to limit airborne dust and particulate matter from roads, materials, storage piles, and tailing piles. A.A.C.R. 18-2-604 through -608.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

The MLRA requires restoration of, or limits impacts to, surface drainages. The APP program (1) regulates the water quality aspects of the hydrologic balance by providing ADEQ with broad authority to require a hydrogeologic study of the area that may be impacted by a discharge; (2) requires a demonstration that a discharge will not result in a violation of aquifer water quality standards; and (3) requires the greatest achievable reduction of discharges. A. R. S. § 49-243. Water quantity issues are regulated by the Arizona Department of Water Resources.

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Surface water quality standards are established pursuant to state statute and rules. A.R.S. § § 49-221 and 222; A.A.C.R. 18-11 -101 through -123. These standards are enforced for discharges to surface waters through both the Clean Water Act National Pollutant Discharge Elimination System ("NPDES") permit program, 42 U.S.C. § 1342, administered by EPA Region IX, and the APP program, which requires an APP for point source discharges to navigable waters. A.R.S. § 49-241. ADEQ certifies federal NPDES and section 404 permits for compliance with state surface water quality standards pursuant to statutory authority. A.R.S. § 49-202. Discharges subject to compliance with aquifer water quality standards under the APP program also must not cause or contribute to a violation of surface water quality standards. A.A.C.R. 18-11-405.B. Finally, the state has both civil and criminal enforcement authority directly over water quality standards violations. A.R.S. § § 49-262 and 49-263.

369

GROUND WATER [*Proposed* 43 CFR 3809.420(b)(2)(ii)]

ADEQ has established aquifer water quality standards by rule pursuant to its statutory authority. A.R.S. §§ 49-221 and 49-223; A.A.C.R. 18-11-401 through -408. By law, all aquifers are classified as drinking water aquifers unless reclassified pursuant to a petition process. A.R.S. § 49-224; A.A.C.R. 18-11-501 through -506. ADEQ must adopt federal primary maximum contaminant levels adopted under the federal Safe Drinking Water Act as aquifer water quality standards, unless ADEQ finds that adoption of such standards is inappropriate. A.R.S. § 49-223. As discussed above, the APP program requires a demonstration that the discharge will not cause or contribute to a violation of an aquifer water quality standard. A.R.S. 5 49-243. Also, the state has direct enforcement authority against violations of aquifer water quality standards. A.R.S. §§ 49-262 and 49-263.

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)

Under the APP program, the definition of "inert material" specifically requires that mine rock be tested for its acid generating potential. A.R.S. § 49-201.18. If the test indicates that it is acid generating, the mine rock typically is considered a "discharging facility," required to obtain an APP permit, and required to comply with BADCT. The determination of BADCT under the APP program for a mine would require the use of controls to mitigate the impacts of acid rock drainage to the groundwater. A.R.S. § 49-243.A. In addition to BADCT, the APP program requires groundwater monitoring at the applicable point of compliance downgradient of the mining operation to ensure that any pollutants discharged from the operation do not cause or contribute to a violation of aquifer water quality standards. A.R.S. § 49-243.B.2.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Arizona must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

BADCT requirements under the APP program require the use of measures to limit sedimentation and erosion and facilitate surface drainage to protect water quality. In addition, the MLRA requires restoration of, or limits impacts to, surface drainages.

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

Soil that is reasonably available from a new area of disturbance must be conserved if the reclamation plan calls for revegetation of the disturbance. A.R.S. 5 27-974. The owner or operator may obtain an exception from this requirement only if recovery of soils is not practicable because of insufficient soil, limitations of topography or other physical constraints, or revegetation of the disturbance is not expected to be successful. *Id.* The rules require posting and erosion protection for soil stockpiles, proper redistribution of soils, and regulation of use of soils from off-site. A.A.C.R. 11-2-703, -704 and -705.

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

If the post-mining land use objective is grazing, wildlife habitat, or forestry, the reclamation plan must include procedures for revegetation. A.A.C.R. 11-2-501. Revegetation plan requirements are specified in the rules. A.A.C.R. 11-2-701. Revegetation standards require the establishment of plant species to support the approved post-mining land use and the establishment of vegetation species, density, or diversity different from pre-existing conditions or conditions on adjacent lands must be justified by differences in post-mining land use, site-specific conditions or erosion control needs. A.A.C.R. 11-2-702.

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

In addition to general requirements for fish and wildlife protection under the federal Endangered Species Act and Arizona game and fish conservation laws, the MLRA contains provisions to encourage the establishment of fish or wildlife habitat as part of post-mining land uses. Fish or wildlife habitat is listed as an appropriate post-mining land use. A.R.S. § 27973. If the proposed post-mining land use is grazing, fish or wildlife habitat, forestry, or recreation, the reclamation plan must identify the type of wildlife or fish habitat to be encouraged, measures to encourage that type of habitat, and a showing that those measures will not be incompatible with fish or wildlife habitat on adjacent lands. A.R.S. § 27-971.B.9.

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

All mine facilities, including buildings and other structures, must be maintained in a safe manner, including restriction of access for public safety by constructing physical barriers and posting warning signs. A.R.S. § 27-975.C: A.A.C.R. 11-2-601. The rules also require reclamation of roads to restore surface drainage patterns or establish new patterns. A.A.C.R. 11-2-603.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

Holes drilled for mineral exploration must be plugged, sealed or capped promptly after their use is completed, unless they are completed for water monitoring, withdrawal or other use. A.R.S. § 27-953.

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

Permanent piles of mine development rock, overburden, and tailings are subject to grading, revegetation or other erosion control measures so that surface drainages are not unduly restricted. A.A.C.R. . 11 -2-602. Closure plans under the APP program require that waste piles remaining after reclamation be closed in a manner that eliminates, to the greatest degree practicable, further discharges from the facility and any reasonable probability of exceeding aquifer water quality standards. A.A.C.R. 18-9-116. As discussed above, "stability" is defined to include erosion potential. The MLRA rules require that "site specific grading, revegetation or other proposed erosion-control measures shall be conducted, as necessary, to address erosion so that permanent piles of mine development rock, overburden, and tailings shall not restrict surface drainages in a manner that contributes to excessive erosion or which compromises the stability of the reclaimed facility." A.A.C.R. 11-2-602.C.

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

Reclamation plans under the MLRA must describe the measures to be taken to achieve erosion control and stability. A.R.S. § 27-971. Mining units must be reclaimed to a stable condition for erosion and seismic activity. A.R.S. § 27-973; A.A.C.R. 11-2-602. In addition to achieving stability and erosion control, the surface of mining units must be reclaimed to achieve the post-mining land use, and measures must be taken to restrict public access to any surface features that may be a hazard to public safety. A.R.S. §§ 27-973.B, 27-975.A. Post-mining land uses are stated in A.R.S. § 27-973.B. Grading and other topographic contouring must be conducted to provide final land forms that are suitable for the post-mining land use objective and stable. A.A.C.R. 11-2-602.

PIT RECLAMATION [*Proposed* 43 CFR 3809.420(c)(7)]

Backfilling or returning material to an open pit, rock face, or subsidence area may be excluded from a reclamation plan if it is impracticable, based upon the consideration of six factors, and if public access to the open pit, rock face or subsidence area is restricted by fencing or other institutional controls. A.R.S. § 49-975.

MAINTENANCE AND PUBLIC SAFETY [*Proposed* 43 CFR 3809.420(c)(10)]

Open shafts would be subject to the requirements for structures, see section above. A qualified engineer must certify that the final land form is stable under static and dynamic conditions considering site-specific seismic conditions, safety consistent with good engineering practices and the hazard to public safety if failure occurs. A.R.S. § 27-973; A.A.C.R. 11-2-602. Measures must be taken to restrict public access to any surface features that may be a hazard to public safety. A.R.S. § 27-975.A.

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

The MLRA requires the establishment of financial assurance based upon a cost estimate for executing the reclamation plan. A.R.S. § 27-992; A.A.C.R. 11-2-802. Various types of financial assurance are allowed. A.R.S. § 27-991; A.A.C.R. 11-2-803 through -812. Financial assurance is not released until all requirements of the MRLA are satisfied. A.R.S. § 27-996; A.A.C.R. 11 -2-817. Financial assurance is subject to forfeiture if reclamation of an exploration operation or mining unit has not been initiated when required or is suspended, if the operator stops conducting business in Arizona without transferring the reclamation plan and financial assurance obligations to a new operator, or for insolvency, bankruptcy, receivership or misconduct of an operator. A.A.C.R. 11-2-818. The process for forfeiture is described in A.A.C. R11-2-819 through -821.

INSPECTION [*Proposed* 43 CFR 3809.600]

The MLRA authorizes ASMI to enter and inspect any exploration operation or mining facility that is subject to the MLRA to determine compliance. A.R.S. § 27-1021. Similarly, ADEQ is authorized to inspect any property from which there is or may be a discharge to enforce the Environmental Quality Act. A.R.S. § 49-203.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

ASMI may issue an administrative compliance order requiring compliance for any violation of the MLRA, its implementing rules, or an approved reclamation plan or if a person is causing an imminent and substantial danger to public safety. A.R.S. § 27-1022. ADEQ also may issue compliance orders requiring compliance for any violation of a water quality standard, APP program requirement, or if a person is creating an imminent and substantial endangerment to public health or the environment. A.R.S. § 49-261.

ENFORCEMENT – PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

Under the MLRA, ASMI may suspend, withdraw or revoke an approved reclamation plan if he determines that the operator is in violation of the MLRA. A.R.S. § 27-1023. ADEQ may revoke a permit for violations of law or a permit, misrepresenting or omitting any fact relevant to an application or permit condition, or causing a violation of an aquifer water quality standard. A.A.C.R. 18-9-121.F.

ENFORCEMENT – SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

Both ASMI under the MLRA and the Director of ADEQ under the Environmental Quality Act may, through the Attorney General, seek injunctive relief in the event of a violation or "imminent and substantial endangerment."

A.R.S. § § 27-1024 and 49-262. In addition, the Arizona Game and Fish Department is authorized to seek an injunction against discharges to surface waters that injure fish or wildlife. A.R.S. § 17-237.
Suits for damages are governed by common law. ADEQ may sue to recover natural resources damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. A.R.S. § 49-287.B.3.

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

Causing a surface disturbance in violation of the MLRA or failing or refusing to conduct reclamation as required by the MLRA constitutes a criminal offense. A.R.S. § 27-1026. Criminal penalties may be imposed under the Environmental Quality Act for discharging without a permit, failing to monitor, sample or report discharges as required by a permit, violating a discharge limitation in a permit, or violating a water quality standard. A.R.S. § 49-263. There also are criminal penalties for certain violations of air quality laws. A.R.S. § 49-502.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

Civil penalties of up to $ 15,000 per violation may be assessed for violations of the MLRA, MLRA rules, a reclamation plan, or a final compliance order. A.R.S. § 27-1024. Civil penalties of up to $25,000 per day may be assessed for violations of any water quality standard, violation of the Environmental Quality Act or a rule or permit condition under the Act, or a final compliance order. A.R.S. § 49-262.C. Civil penalties also are authorized under state and county air pollution control laws. See A.R.S. § 49-451.

CITIZEN SUITS [No provision in proposed rule]

The Environmental Quality Act authorizes citizen suits against ADEQ for nondiscretionary acts or duties under the Act. A.R.S. § 49-264. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

CALIFORNIA

Mining operations in California are regulated by a number of state, regional and local agencies. The Division of Mines and Geology (Division) in the Department of Conservation oversees implementation of the Surface Mining and Reclamation Act (SMARA). Cal. Pub. Res. Code div. 2, ch. 9 (as amended), 14 Cal. Code of Regs. § § 3500 - 3, 3700 - 13. SMARA is administered primarily by county planning directors, commissions, and boards of supervision. SMARA prohibits surface mining without an operating permit, an approved reclamation plan, and the posting of a financial assurance. Cal. Pub. Res. Code § 2770(a). An operator must post a financial assurance to guarantee that reclamation is performed in accordance with an approved reclamation plan. Cal. Pub. Res. Code § 2773.1. Mining operations must comply with the provisions of the Porter-Cologne Water Quality Act, Cal. Water Code div. 7, ch. 1 - 10, and implementing regulations, Title 27 of the California Code of Regulations, adopted by the California Water Resources Control Board and administered by nine Regional Water Quality Control Boards, including the "Title 27" regulations which specify design, construction, operation, monitoring, financial assurance, closure and post-closure mine waste discharge requirements. §§ 22470 - 22510. In addition, the provisions of the California Air Pollution Control laws, Cal. Health & Safety Code C § 39000 - 44563, and implementing regulations 17 Cal. Code of Regs. div. 3, ch. 1, adopted by the California Air Resources Board and administered by Air Quality Management or Air Pollution Control Districts apply to mining operations.

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Mining operations must comply with the provisions of the California Air Pollution Control laws, Cal. Health & Safety Code § § 39000-44563, and implementing regulations, 17 Cal. Code of Regs. div. 3, ch. 1, administered by the California Air Resources Board. In addition, because mining operations are non-vehicular sources of pollution, they are subject to regulatory control by California's 35 local and regional Air Pollution Control Districts. The

California air districts have adopted rules, regulations, and permit programs that pertain to polluting activities in accordance with state and federal law. Each source must consult the rules of the air district in which it is located prior to construction and/or operation. The In addition, because mining operations are non-vehicular sources of pollution, they are subject to regulatory control by California's 35 local and regional Air Pollution Control Districts. The air program includes standards applicable to fugitive dust, particulates, and emissions from milling and processing operations, including oxides of nitrogen and toxic air contaminants. Many of the air quality requirements are part of California's State Implementation Plan (SIP) required by the federal Clean Air Act. 42 U.S.C. § 7410.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

Surface mining and reclamation activities must be conducted to protect on-site and downstream beneficial uses of water in accordance with other state and federal laws. Cal. Pub. Res. Code § 2773(b)(4), 14 Cal. Code of Regs. § 3707. Surface and ground water must be protected from siltation and pollutants, which may diminish, water quality. 14 Cal. Code of Regs. § 3710. In addition, operators of mining waste management units must comply with the Title 27 program implemented by Regional Water Quality Control Boards, including the requirement to submit information on "waste Characteristics" which could affect the waste's potential to cause acid or toxic pollution. The Title 27 implementing regulations require that such units be closed "so that they no longer pose a threat to water quality." Title 27 § 22510(a).

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

SMARA performance standards require operators to protect surface water from siltation and pollutants, which could diminish water quality. 14 Cal. Code of Regs. § 3710(a). Point source discharges to surface waters from mining operations must obtain a National Pollutant Discharge Elimination System (NPDES) permit from of California's Regional Water Quality Control Boards. An NPDES permit requires compliance with surface water quality standards and the State's antidegradation policy for surface water. 23 Cal. Code of Regs. Div. 7, ch. 9, art. 3. Additionally, operators must comply with NPDES storm water requirements. 40 CFR 122.26.

GROUND WATER [*Proposed* 43 CFR 3809.420(B)(2)(ii)]

SMARA performance standards require operators to protect ground water from siltation and pollutants, which could diminish water quality. 14 Cal. Code of Regs. § 3710(a). In addition, all mining waste management units are regulated by Regional Water Quality Control Boards which establish site-specific waste discharge requirements to ensure compliance with ground water quality standards and the State's antidegradation policy for ground water. Title 27 §§ 22470 – 22510 of the California Code of Regulations.

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

California Water Code § 13260(1) requires that, for purposes of obtaining waste discharge requirements (i.e., a permit) from a Regional Water Quality Control Board for a discharge of mining waste, a report must be submitted on the physical and chemical characteristics of the waste that could affect its potential to cause pollution or contamination. The report must contain the results of tests to determine the acid-generating potential of the mining waste, and evaluate the potential of a discharge of such waste to produce, over the long term, acid mine drainage, including the discharge or leaching of heavy metals. The classification of mining wastes for purposes of management requirements under the Title 27 program is based in part on the acid-generating potential of the mining waste. 27 Cal. Code of Regs. § 22480. Mining waste management units are to be closed such that they no longer pose a threat to water quality. 27 Cal. Code of Regs. § 22510.

374

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, California must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

All surface mining and reclamation activities must be conducted to protect beneficial uses of surface water and control erosion, sedimentation, gullying and contamination. Cal. Pub. Res. Code § 2773(b)(4), 14 Cal. Code of Regs. § 3707. Erosion and sedimentation must be controlled during all phases of construction, operation, reclamation, and closure in order to minimize siltation of lakes and watercourses. 14 Cal. Code of Regs. § 3706(c). Surface water runoff and drainage from surface mining operations must be controlled to ensure that surrounding land end water resources are protected from erosion, gullying, sedimentation and contamination. 14 Cal. Code of Regs. § 3706(d). If natural drainages are impacted by surface mining activities, mitigation measures must be taken to assure that surface water runoff does not increase erosion or sedimentation. 14 Cal. Code of Regs. § 3707(e). Stream diversions must be constructed in accordance with other laws and, when no longer needed, all temporary stream channel diversions must be removed and the affected land reclaimed. 14 Cal. Code of Regs. § 3706(g). Piles or dumps of mining waste and overburden may not be permanently placed in wetlands without acceptable mitigation to offset wetland impacts and losses. 14 Cal. Code of Regs. § 3704(g).

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

When an approved reclamation plan approved after 1991 requires revegetation or cultivation, operators must comply with SMARA performance standards for topsoil including requirements regarding the segregation, maintenance, and redistribution of topsoil. Cal. Pub. Res. Code § 2773(b)(8). Soil practices must be used where necessary to control water and wind erosion, including fugitive dust, and promote successful revegetation. 14 Cal. Code of Regs. § 3711. All salvageable topsoil suitable for revegetation must be removed as a separate layer from areas to be disturbed and topsoil and vegetation removal must not precede surface mining activities by more than one year. 14 Cal. Code of Regs. § 3711 (a). If sufficient topsoil is unavailable, other suitable material capable of sustaining vegetation must be removed as a separate layer use as a growth media. 14 Cal. Code of Regs. § 3711(b). Topsoil and suitable growth media that cannot be used immediately for reclamation, must be (1) stockpiled in an area where they will not be disturbed until needed for reclamation and (2) planted with a vegetative cover, or protected by equally effective measures from water and wind erosion and to discourage weeds. 14 Cal. Code of Regs. § 3711 (d). Topsoil stockpiles must be segregated from mine waste dumps. 14 Cal. Code of Regs. § § 3704(c), 3711 (d). Additional performance standards for topsoil salvage, maintenance and redistribution apply to mining operations on prime agricultural lands where the approved post-mining land use is agriculture. 14 Cal. Code of Regs. § 3707.

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

All surface mining and reclamation activities must comply with SMARA performance standards for revegetation, and reclamation must include revegetation unless revegetation is inconsistent with the approved post-mining land use. Cal. Pub. Res. Code § 2773(b)(3), 14 Cal. Code of Regs. § 3705. SMARA revegetation performance standards require operators to use a vegetative cover of native species, which (1) is capable of self-regeneration, (2) stabilizes the surface, and (3) protects against erosion. 14 Cal. Code of Regs. § 3705(a), (g). Operators must grow test plots of vegetation simultaneous with mining, 14 Cal. Code of Regs. § 3705(b), eliminate soil compaction, establish a suitable root zone before revegetation begins, 14 Cal. Code of Regs. § 3705(c), and conduct soil testing, 14 Cal. Code of Regs. § 3705(e). Operators must plant during "the most favorable time of the year for plant establishment," 14 Cal. Code of Regs. § 3705(h), and use "soil stabilizing practices" to control erosion and facilitate plant

375

establishment. 14 Cal. Code of Regs. § 3705(i). All roads must be revegetated, 14 Cal. Code of Regs. § 3705(d), and efforts must be taken to prevent interference with efforts to restore vegetation to lands affected by mining operation. 14 Cal. Code of Regs. § 3705(f) (temporary access roads, (l) (grazing). The success of revegetation will be judged by the effectiveness of the vegetation for the approved post-mining land use and by comparing the quantified measures of vegetative cover, density, and species-richness of the reclaimed lands to similar parameters of naturally occurring vegetation in the area. 14 Cal. Code of Regs. § 3705(m).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

Mining operations and reclamation activities must comply with SMARA performance standards for wildlife habitat. Cal. Pub. Res. Code § 2773(b)(1), 14 Cal. Code of Regs. § 3703. State or federally listed rare, threatened, or endangered species, and their respective habitat, must be avoided and, if avoidance is impossible, mining operations must take mitigation measures. 14 Cal. Code of Regs. § 3703(a). Wildlife habitat must be established on disturbed land "in a condition at least as good as that which existed before the lands were disturbed." 14 Cal Admin. Code § 3703(b). Wetland habitat must be avoided and any wetland habitat impacted by surface mining operations must be mitigated at a minimum of one-to-one ratio for wetland habitat acreage and wetland habitat value. 14 Cal Admin. Code § 3703(c) . Any stream alterations require a 1603 agreement from the Department of Fish and Game, a 404 permit from the Corps of Engineers, and a 401 certification from the State Water Resources Control Board.

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

All roads must be revegetated. 14 Cal. Code of Regs. § 3705(d). Mining operations must store all equipment, supplies, and other materials in areas designated in the approved reclamation plan. 14 Cal. Code of Regs. § 3709(a). All buildings, structures, and equipment must be dismantled and removed before final mine closure except as needed for the approved post-mining land use. Cal. Pub. Res. Code § 2773(b)(6), 14 Cal. Code of Regs. § 3709(b).

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

All drill holes, water wells, and monitoring wells must be completed or abandoned in a manner consistent with applicable legal requirements. 14 Cal. Code of Regs. § 3713(a). Prior to closure, all portals, shafts, tunnels, or other surface openings to underground workings must be gated or otherwise protected from public entry in order to eliminate any threat to public safety and to preserve access for wildlife habitat. 14 Cal. Code of Regs. § 3713(b).

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

Mine waste disposal units, including waste rock piles, heap leach piles, and tailings ponds and impoundments, must still comply with the Title 27 mine waste disposal regulations promulgated by the California Water Resources Control Board and the SMARA reclamation performance standards, including surface restoration and vegetation. Cal. Pub. Res. Code § 2773(b)(9). The Title 27 regulations require all mining waste management units to be closed (1) according to an approved closure and post-closure maintenance plan, which must incorporate the provisions of the SMARA reclamation plan, and (2) so that they no longer pose a threat to ground or surface water quality. Title 27 § 22510(a), (b). Mining waste includes overburden, waste rock, and tailings. Title 27 § 22480(a). All fill slopes, including permanent piles or dumps of mine waste and overburden, and cut slopes must conform to the surrounding topography and the approved post-mining land use and which can be revegetated. 14 Cal. Code of Regs. § 3704(e), (f).

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

At reclamation, an operator must comply with SMARA performance standards for backfilling, regrading, slope stability, and recontouring. Cal. Pub. Res. Code § 2773(b)(2), 14 Cal. Code of Regs. § 3704. Final reclaimed slopes must have a minimum slope stability factor of safety that is suitable for the approved post-mining land use.

14 Cal. Code of Regs. § 3704(d). All fill slopes, including permanent piles or dumps of mine waste and overburden, and cut slopes must conform to the surrounding topography and the approved post-mining land use and which can be revegetated. 14 Cal. Code of Regs. § 3704(e), (f). Topsoil and suitable growth media must be redistributed in a manner that results in a stable, uniform thickness consistent with the approved post-land use, site configuration, and drainage patterns. 14 Cal. Code of Regs. § 3711 (e).

PIT RECLAMATION [*Proposed* 43 CFR 3809.420(c)(7)]

Where backfilling is required for urban uses, the fill material must be appropriately compacted. 14 Cal. Code of Regs. § 3704(a). Where backfilling is required for resource conservation purposes, fill material must be backfilled to the standards required for the resource conservation use involved. 14 Cal. Code of Regs. § 3704(b).

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.590 – 599]

A financial assurance, such as a bond, letter of credit, or certificate of deposit, is required for all mines. It must be updated annually to cover all reclamation costs. SMARA authorizes forfeiture of an operator's financial assurance if the operator is financially incapable of performing reclamation or has abandoned the operation. Cal. Pub. Res. Code § 2773.1(b). The Regional Water Quality Boards also impose financial assurance requirements under the Title 27 program for mine waste discharges.

INSPECTION [*Proposed* 43 CFR 3809.600]

SMARA requires inspections to determine compliance with the approved reclamation plan at least once a year and inspections must be conducted within six months after an operator files an annual report detailing the mine" status. Cal. Pub. Res. Code § 2774(b). The annual report must include proof of annual inspection along with other information about the status of the mining operation and the condition of the site. Cal. Pub. Res. Code § 2207. Inspections to ensure compliance with the Porter-Cologne Water Quality Act and the California Air Pollution Control laws are conducted, respectively, by the Regional Water Quality Control Boards and the Air Quality Districts.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

SMARA authorizes the issuance of administrative orders to (1) compel compliance with SMARA or (2) require cessation on mining activities occurring without an approved reclamation plan or financial assurance. Cal. Pub. Res. Code § 2774.1(a). Operators who fail to comply with such an order are potentially subject to administrative penalties of $5,000 per day. Cal. Pub. Res. Code § 2774.1(c). Administrative enforcement orders also are authorized by the Porter-Cologne Water Quality Act, Cal. Water Code Div. 7, ch. 5, and the California Air Pollution Control laws. Cal. Health & Safety Code div. 26, pt. 4, ch. 4.

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

Operating permits issued under the authority of SMARA can be suspended or revoked by the lead permitting agency, usually the county planning commission, pursuant to local mining ordinances. Regional Water Quality Control Boards and the Air Quality Districts can suspend or revoke permits issued pursuant to the Porter-Cologne Water Quality Act or the California air Pollution Control laws.

ENFORCEMENT -- SUIT FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

If a surface mine presents an imminent and substantial endangerment to the public health or environment because of noncompliance with SMARA, a court order to enjoin the mining operation may be sought. Cal Pub. Res. Code § 2774.1(d). Injunctive relief also can be sought for violations of the Porter-Cologne Water Quality Act, Cal. Water Code div. 7., ch. 5, and the California Air Pollution Control laws. Cal. Health & Safety Code § 42453. Natural resource damages, in addition to removal costs, can be assessed for killing fish and wildlife. Cal. Fish & Game Code § § 12014, 12015, 12016.

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

SMARA does not authorize criminal penalties. The Porter-Cologne Water Quality Act identifies the following as misdemeanors: failing to file reports of waste discharge; failing to file or falsifying technical or monitoring information required by RWQCB; knowingly filing a false report of waste discharge with regard to the discharge of hazardous waste; willfully withholding material information with regard to the discharge of hazardous waste; and failing to notify the State of discharges of hazardous substances into state waters. Cal. Water Code § § 13261, 13265, 13268, 13271. Stiffer criminal penalties may be assessed for negligent or intentional violation of waste discharge requirements for point source discharges to surface waters. Cal. Water Code § 13387. Criminal penalties may be assessed for deleterious substances, which impact, or threaten waters of the state. Cal. Fish & Game Code § 5650. Criminal penalties also are authorized under California's air pollution laws. Cal. Health & Safety Cod div. 26, pt. 4, ch. 4.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

Operators who fail to comply with administrative orders issued under SMARA are subject to administrative penalties, Cal. Pub. Res. Code § 2774.1(c), which can be recovered in a judicial action. Cal. Pub. Res. Code § 2774.1(e). Civil penalties can be assessed against operators who fail to file the annual operating report required by SMARA. Cal. Pub. Res. Code § 2774.1(c). The Porter-Cologne Water Quality Act authorizes civil liability to be assessed for violations of administrative orders either by the Regional Water Quality Control Boards or a court. Cal. Water Code Div. 7, ch. 5. Civil penalties also are authorized under California's air pollution laws. Cal. Health & Safety Code div. 26, pt.4, ch. 4.

CITIZEN SUITS [No provision in proposed rule]

SMARA does not authorize citizen suits. The California Environmental Quality Act authorizes citizen suits against State agencies, including the Department of Conservation, with respect to LEQA compliance. Cal. Pub. Res. Code § 21167. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

COLORADO

The Division of Minerals and Geology (Division) in the Colorado Department of Natural Resources has primary responsibility for the regulation of mining operations. The Division is overseen by the Mined Land Reclamation Board (Board). The Division administers the Colorado Mined Land Reclamation Act (MLRA), Colo. Rev. Statutes (C.R.S.) §§ 34-32-101 et seq., and the MLRA implementing regulations. 2 Code of Colo. Reg. (C.C.R.) § 407-1. The MLRA requires all hard rock metal mining operations to obtain a reclamation permit from the Board. C.R.S. § 34-32-109(7). A reclamation permit cannot be issued without an approved reclamation plan, C.R.S. § 34-32-112(1)(b), the posting of a performance warranty, and the posting of a financial warranty in an amount sufficient to reclaim all lands to be affected during the year. C.R.S. § 34-32-117. In addition, pursuant to the 1993 amendments to the MLRA, an environmental protection plan is required before the issuance of reclamation permits for designated mining operations. C.R.S. § 34-32-116.5. Designated mining operations are those mining operations at which "toxic or acidic chemicals used in extractive metallurgical processing are present on-site," or "acid or toxic-forming materials will be exposed or disturbed as a result of mining operations." C.R.S. § 34-32-103(3.5). Reclamation activities are to be conducted concurrent with mining operations to the extent practicable. C.R.S. § 34-32-116(7)(q). Mining operations and reclamation activities also must comply with the Colorado Water Quality Control Act, C.R.S. tit. 25, art. 8, and the Colorado Air Pollution Prevention and Control Act, C.R.S. tit. 25, art. 7, administered by the Colorado Department of Public Health and Environment (CDPHE).

378

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Mining operations must comply with the Colorado Air Pollution Prevention and Control Act, C.R.S. tit. 25, art. 7, including construction and operating permit requirements administered by the CDPHE. Operators must use control measures and operating procedures as necessary to control fugitive particulate emissions from mining, haul roads, haul trucks, tailings piles and ponds, and blasting, as well as activities incidental to mining. A prohibition of off-property transport of air particulates, nuisance emission limitations and a 20% opacity guideline are applied to these activities. 5 C.C.R. § 1001-3, III.D.2 (d), (e), (f), (g), (I). In addition, operators must ensure that all surface areas of the affected land, including spoil piles, are stabilized and protected so as to effectively control erosion and attendant air and water pollution. C.R.S. § 34-32-116(7)(i). Air quality requirements are part of Colorado's State Implementation Plan (SIP) required by the federal Clean Air Act, and Colorado's implementation of the permit requirements of Title V of the Clean Air Amendments of 1990, 42 U.S.C. § 7410 (State Implementation Plans); 42 U.S.C. § 7661 (Title V Operating Permit Requirements).

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

An operator must minimize disturbances to the prevailing hydrologic balance and to the quality and quantity of surface and ground water of the affected land and surrounding area during and after the mining operation and during reclamation. C.R.S. § 34-32-116(7)(g). Measures to minimize such disturbances include: (1) complying with applicable Colorado water laws and regulations governing injury to existing water rights; (2) complying with applicable federal and Colorado water quality laws and regulations; (3) complying with applicable federal and Colorado dredge and fill requirements; and (4) removing temporary or large siltation structures from drainways after disturbed areas are revegetated and stabilized. 2 C.C.R. § 407-1, 3.1.6(1). The MLRA requires the Division to ensure that all affected lands are stabilized and protected to effectively control erosion and attendant air and water pollution. C.R.S. § 34-32-116(7)(i).

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Mining operations must obtain a Colorado Discharge Permit System (CDPS) permit from the CDPHE for all additions of pollutants into surface waters from point sources. C.R.S. § 25-8-501(1). A CDPS permit will establish the location, quantity, and quality characteristics of permitted discharges. 5 C.C.R. § 5-1002-2, 6.9.3(2)(b). Mining operations must comply with Colorado's antidegradation rule and surface water quality standards. 5 C.C.R. § 5-1002-8, 3.1. An operator must minimize disturbances to the prevailing hydrologic balance and to the quality and quantity of surface and ground water to the affected land and surrounding area during and after the mining operation and during reclamation. C.R.S. § 34-32-116(7)(g).

GROUND WATER [*Proposed* 43 CFR 3809.420(b)(2)(ii)]

Under the Colorado Water Quality Control Act, the Water Quality Control Division of the CDPHE is responsible for implementing state water classifications and water quality standards for discharges to ground water from mining operations. The Division is responsible for setting points of compliance for such discharges at mine sites. C.R.S. § 25-8-202(7). Mining operations cannot cause a violation of Colorado ground water quality standards. 2 C.C.R. § 407-1, 3.1.7(1), 5 C.C.R. § 5-1002-8, 3.11. An operator must minimize disturbances to the prevailing hydrologic balance and to the quality and quantity of surface and ground water to the affected land and surrounding area during and after the mining operation and during reclamation. C.R.S. § 34-32-116(7)(g), 2 C.C.R. § 407-1, 3.1.6(1).

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

The MLRA requires acid-forming or toxic-producing materials exposed by mining "to be handled in a manner that will protect the drainage system from pollution." C.R.S. § 34-32-116(7)(c); 2 C.C.R. § 407-1, 3.1.5(5).

The MLRA implementing regulations define "acid mine drainage" ("AMD") as contamination of water by either low pH or metals. 2 C.C.R. § 407-1, 1.1(2). The regulations require operators of designated mining operations ("DMOs") to submit to the Board for approval, an environmental protection plan which will assure that control measures will be put in place to prevent releases of acid or toxic substances during and after mining. 2 C.C.R. § 407-1, 6.1.4. DMO's are those mining operations at which (a) designated chemicals used in the extractive metallurgical process are present on site or (b) toxic or acid-forming materials will be exposed or disturbed as a result of mining or reclamation. C.R.S. § 34-32-103 (3.5). "Designated chemicals" are chemicals that, at certain concentrations, represent a potential threat to human health, property or the environment. 2 C.C.R. § 407-1, 1.1(13). If the Division believes that an operation has the potential to be a DMO, yet the operator believes it does not, the operator may conduct testing and present results to the Division for approval. 2 C.C.R. § 407-1, 7.2.4. Operators must outline measures to be taken to prevent the release of AMD in the environmental protection plan. 2 C.C.R. § 407-1, 6.4.20(6). These may include, but are not limited to, measures such as low permeability caps and covers, surface water diversion structures, selective handling, selective storage, addition of alkaline amendments, and temporary water treatment. While mining is in progress, control measures must be implemented to prevent releases of AMD. Depending on the site, the permit, and the nature of the ore and waste rock, surface and/or ground water monitoring may be required, as may rock testing, to guide selective handling of ore or waste rock. After mining ceases and reclamation begins, operations must be free of AMD releases for a monitoring period of at least five years.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Colorado must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

The MLRA requires operators to segregate and maintain topsoil removed from affected land. Topsoil must be preserved from wind and water erosion, remain free of any contamination by any acid or toxic material, and be in a useable condition for sustaining vegetation when restored during reclamation. C.R.S. § 34-32-116(7)(f), 2 C.C.R. § 407-1, 3.1.9(1). Topsoil stockpiles must be stored in places and configurations to minimize erosion and disturbance by ongoing mining operations. 2 C.C.R. § 407-1, 3.1.9(3). Once stockpiled, topsoil must be rehandled as little as possible until replacement on the regraded, disturbed area. 2 C.C.R. § 407-1, 3.1.9(4). An operator must take measures to assure the stability of replaced topsoil on graded slopes, such as roughing in final grading to eliminate slippage zones that may develop between the deposited topsoil and heavily textured spoil surfaces. 2 C.C.R. § 407-1, 3.1.9(5). If topsoil is of insufficient quantity or of poor quality for sustaining vegetation, and if other materials can be shown to be more suitable for vegetative requirements, the operator must remove, segregate, and preserve in a like manner such other materials which are best able to support vegetation. 2 C.C.R. § 407-1, 3.1.9(6).

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

An operator must establish a "diverse, effective, and long-lasting vegetative cover that is capable of self-regeneration and at least equal in extent of cover to the natural vegetation of the surrounding area." C.R.S. § 34-32-116(7)(e). Except for certain post-mining land uses (forestry and range), an operator must emphasize species native to the region. 2 C.C.R. § 407-1, 3.1.10(1). The revegetation development is to take into consideration environmental factors such as seasonable patterns of precipitation, temperature and wind; soil texture and fertility; slope stability; direction of slope faces; and biological factors. 2 C.C.R. § 407-1, 3.1.10(4). To ensure the establishment of a diverse and long-lasting vegetative cover, the operator must use appropriate techniques of site preparation and protection such as mechanical soil conditioning by discing and ripping, mulching, soil amendments and fertilization, and irrigation. 2 C.C.R. § 407-1, 3.1.10(5). No planting is required (1) on lands used for the disposal of refuse until cessation of operations; (2) on lands proposed for future mining; (3) on depressed haulage roads or final cuts when in use; (4) where permanent pools or lakes have been formed; or (5) on affected lands that are toxic, deficient in plant nutrients, or composed of sand, gravel, shale or stone that inhibits plant growth, and which cannot be remediated. 2 C.C.R. § 407-1, 3.1.10(8).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

Applicants for reclamation permits for designated mining operations must consult with the Colorado Division of Wildlife, and wildlife protection measures will be incorporated into the reclamation permits. C.R.S. § 34-32-116.5(6). All aspects of a mining and reclamation plan must take into account the safety and protection of wildlife on the mine site, at processing sites, and along all access roads to the mine site with special attention given to critical periods in the life cycle of those species which require special consideration, such as elk calving, migration routes, peregrine falcon nesting, and grouse strutting grounds. 2 C.C.R. § 407-1, 3.1.8.

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

If the affected land is owned by a legal entity other than any local, state, or federal entity, any buildings or structures which are constructed or placed on the affected lands in conjunction with the mining operations and have significant historical value may remain after reclamation if they will not conflict with the post-mining land use. C.R.S. § 34-32-116(7)(R); 2 C.C.R. § 407-1, 3.1.11.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

All drill or auger holes that are part of a mining operation must be plugged with noncombustible materials that will prevent harmful or polluting drainage. Adits and shafts must be sealed, and where practicable, backfilled and graded. 2 C.C.R. § 407-1, 3.1.5(6).

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

All surface areas of the affected land, including spoil piles, must be stabilized and protected so as to effectively control erosion and attendant air and water pollution. C.R.S. § 34-32-116(7)(i).

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

The MLRA requires that areas surrounding the affected land be protected from slides or damages during mining operations or reclamation activities. C.R.S. § 34-32-116(7)(h), 2 C.C.R. § 407-1, 3.1.5(3). All surface areas of the affected land, including spoil piles, must be stabilized and protected so as to effectively control erosion and attendant air pollution, including fugitive dust, and water pollution. C.R.S. § 34-32-116(7)(i). All grading must be done in a manner to control erosion and siltation of the affected lands and to protect areas outside the affected land from slides and other damage. 2 C.C.R. § 407-1, 3.1.5(3).

The MLRA requires all grading to create a "final topography appropriate to the final land use" of the affected land. C.R.S. § 34-32-116(7)(a). All grading must be done in a manner to control erosion and siltation of the affected lands and must be stabilized. If not eliminated, all highwalls must be stabilized. 2 C.C.R. § 407-1, 3.1.5(3). All backfilling and grading must be completed as soon as feasible after mining. 2 C.C.R. § 407-1, 3.1.5(4). Maximum slopes and slope combinations must be compatible with the configuration of surrounding conditions and the final land use. 2 C.C.R. § 407-1, 3.1.5(7).

PIT RECLAMATION [*Proposed* 43 CFR 3809 .420(c)(7)]

If an approved reclamation plan includes backfilling, the operator must replace overburden and waste materials in the mined areas and ensure adequate compaction for stability and prevent leaching of toxic or acid-forming materials. 2 C.C.R. § 407-1, 3.1.5(2).

FINANACIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

Prior to obtaining a reclamation permit an operator must give a performance warranty and financial warranty approved by the Board. C.R.S. § 34-32-117(1). A performance warranty is a written promise to comply with the requirements of the MLRA. C.R.S. § 34-32-117(2). Financial warranties consist of a written promise to be responsible for reclamation costs, together with proof of financial responsibility. C.R.S. § 34-32-117(3). Proof of financial responsibility may consist of a surety bond, letter of credit, certificate of deposit, deed of trust or security agreement encumbering real or personal property creating a first lien in favor of the State, a trust fund held by an independent trustee, or certification of the warrantor by an independent auditor. C.R.S. § 34-32-117(3)(f). The Board prescribes the amount and duration of financial warranties and periodically reviews their continued adequacy. The Board may increase or decrease the amount and duration of required warranties. C.R.S. § 34-32-117(4). A financial warranty is subject to forfeiture for: (1) violating a cease and desist order; (2) failing to complete a corrective action; (3) defaulting on a performance warranty; (4) failing to maintain a financial warranty in good standing; or (5) lacking the financial ability to fulfill MLRA reclamation requirements. C.R.S. § 34-32-118(1). The Board will use forfeited funds to reclaim the lands covered by the financial warranties. C.R.S. § 34-32-118(5).

INSPECTION [*Proposed* 43 CFR 3809.600]

The Division must inspect a proposed surface mining operation before issuing a reclamation permit, 2 C.C.R. § 407-1, 3.2(7), and before releasing performance and financial warranties. C.R.S. § 34-32-117(5)(a). The MLRA authorizes inspection of a mining operation at any time to determine compliance with the terms of the MLRA. C.R.S. § 34-32-121, 2 C.C.R. § 407-1, 3.2(1). The CDPHE also possesses authority to inspect at any reasonable time under the Water Quality Control Act, C.R.S. § 25-8-306, and the Air Pollution Prevention and Control Act. C.R.S. § 25-7-111(c).

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

The MLRA authorizes the issuance of cease and desist orders for operating without a valid reclamation permit, C.R.S. § 34-32-123(1), violating MLRA statutory or regulatory provisions, or violating reclamation permit conditions. C.R.S. § 34-32-124(2)(a). Such orders may set forth alleged violations, time deadlines for termination of acts or practices complained of, and/or corrective actions, C.R.S. § 34-32-124 (2)(a). The CDPHE also possesses authority to issue administrative orders under the Water Quality Control Act, C.R.S. § § 25-8-605, 606, and the Air Pollution Prevention and Control Act. C.R.S. § § 25-7-115, 118, 119.

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

The Board may revoke a reclamation permit for violating MLRA statutory or regulatory provisions or permit conditions. C.R.S. § 34-32-124(6). The CDPHE also can suspend or revoke permits issued under the Water Quality Control Act, C.R.S. § 25-8-604, and the Air Pollution Prevention and Control Act. C.R.S. § 25-7-115.

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

The MLRA authorizes temporary restraining orders or preliminary or permanent injunctions to enjoin any mining operation operating without a valid reclamation permit, C.R.S. § 34-32-123(1), violating MLRA statutory or regulatory provisions, or violating reclamation permit conditions. C.R.S. § 34-32-124(3). The CDPHE also can seek to enjoin activities which violate the Water Quality Control Act, C.R.S. § 25-8-607, and the Air Pollution Prevention and Control Act. C.R.S. § 25-7-121. The MLRA authorizes the Board to recover from a mine operator any funds spent from an emergency response cash fund, established by the 1993 amendments to the MLRA, to respond to emergencies at mining operations. C.R.S. § 34-32-122(3)(c)(I). The Board also can seek to recover any cost from a mine operator, including administrative costs, incurred in carrying out a corrective action necessitated by MLRA violations. C.R.S. § 34-32-124(2)(b). Other suits for damages are governed by common law. The state may sue to recover natural resource damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980. 42 U.S.C. § 9607(f).

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

The MLRA does not establish criminal penalties for violations of its provisions. Criminal penalties up to $25,000 per day per violation can be assessed for violations of the Colorado Water Quality Control Act, C.R.S. § 25-8-609. Second convictions incur double the fine. Violations of the Air Pollution Prevention and Control Act are punishable as misdemeanors and violators may incur fines up to $25,000 per day per violation. Second convictions incur $50,000 per day per violation. C.R.S. § 25-77-122.1. Any violator who knowingly places other persons in imminent danger of death or serious bodily injury is guilty of a felony punishable by fines up to $50,000 per day per violation and/or up to four years imprisonment. C.R.S. § 25-77-122.1.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

The MLRA authorizes civil penalties of not less than $1,000 per day nor more than $5,000 per day for operating without a valid reclamation permit or mining beyond the approved permit boundary. C.R.S. § 34-32-123(2). Violations of MLRA permit conditions subject operators to civil penalties of not less than $100 per day nor more than $1,000 per day for each day the violation occurs. C.R.S. § 34-32-124(7). The CDPHE also can seek to have civil penalties imposed for violations, of up to $10,000 per day per violation, for violations of the Water Quality Control Act, C.R.S. § 25-8-608, and up to $15,000 per day per violation for violations of the Air Pollution Prevention and Control Act. C.R.S. § 25-7-122.

CITIZEN SUITS [No provision in proposed rule]

Neither the MLRA nor Colorado environmental laws authorize citizen suits. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

IDAHO

In Idaho, surface mining operations, including reclamation, are regulated primarily by the Idaho Department of Lands, which is overseen by the Idaho Board of Land Commissioners. The Department of Lands administers the Idaho Surface Mining Act. Idaho Code tit. 47, ch. 15, IDAPA § 20.03.02. Before surface mining operations can begin, a reclamation plan must be approved by the Department of Lands, Idaho Code § 47-1506(a)(3), (b). IDAPA

§ 20.03.02.070.01, and a performance bond posted in an amount equal to reasonable costs of reclamation under the reclamation plan, not to exceed $2500 per acre. The board may require a bond for more than $2500 per acre upon notice to the operator and an opportunity for a hearing. Idaho Code § 47-1512. An approved reclamation plan governs and determines the nature and extent of reclamation obligations. Idaho Code § 47-1507(a). Surface mining operations also must comply with surface and ground water quality standards, IDAPA § 16.01.02, and air pollution control requirements, IDAPA § 16.01.01, promulgated pursuant to the authority of the Idaho Environmental Protection and Health Act, Idaho Code tit. 39, ch. 1, and administered by the Idaho Division of Environmental Quality (IDEQ) in the Department of Health and Welfare. Facilities which use cyanide to process ore must comply with Idaho's cyanidation statute and regulations administered by the IDEQ. Idaho Code § 39-118A, IDAPA § 16.01.13000. These facilities must be permitted before construction, IDAPA § 16.01.13100.01, which requires an approved permanent closure plan, IDAPA § 16.01.13100.01, and sufficient financial assurance to guarantee closure, not to exceed $100,000 for the entire facility. IDAPA § 16.01.13650.02.

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

The air pollution control provisions of the Idaho Environmental Protection and Health Act, Idaho Code tit. 39, ch. 1, and implementing regulations, IDAPA § 16.01.01, apply to mining operations. IDEQ issues construction and operating permits for mining facilities which emit air pollutants including fugitive dust. All mining operations must take "all reasonable precautions" to prevent the generation of fugitive dust. IDAPA § 16.01.1251. Air quality requirements are part of Idaho's State Implementation Plan (SIP) required by the federal Clean Air Act. 42 U.S.C. § 7410.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

Facilities which process ore by cyanidation must submit a water management strategy to IDEQ, which describes the hydrogeologic regime of the site and details the actions the operator will take to maintain that prevailing hydrologic regime. IDAPA § 16.01.13100.03.e, h, iii. Operators must use best management practices designed, constructed and maintained to control non-point source sediments to achieve state water quality standards and protect existing beneficial uses of adjacent surface waters. IDAPA § 20.03.02140.01. Similar efforts must be made at the close of each operating season.

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Point source discharges to surface waters from mining operations must have a National Pollutant Discharge Elimination System (NPDES) permit issued by the United States Environmental Protection Agency. 42 U.S.C. § 1342. Mine operators cannot discharge any pollutant in concentrations which may violate water quality standards, IDAPA § 16.01.02080.01, and must use best management practices to control non-point source pollution and storm water runoff to achieve state water quality standards. IDAPA § § 16.01.02350, 20.03.02140. Mining operations in Idaho must comply with the State's antidegradation policy. IDAPA § 16.01.02051, Exec. Order No. 88-23 (Nov. 14, 1988). A surface water monitoring program will be required for mining facilities which use cyanide. IDAPA § 16.01.13200.04.

GROUND WATER [*Proposed* 43 CFR 3809.420(b)(2)(ii)]

Ground water quality must be monitored during operations and after closure. IDAPA § 16.01.13200.04. Mining operations cannot discharge any solution, which causes a violation of the State's ground water quality standards, IDAPA § § 16.01.02080.01, 02299, and 16.01.11200,11400 and must comply with the State's antidegradation policy. IDAPA § 16.01.02051, Exec. Order No. 88-23 (Nov. 14, 1988). In addition, wells must be constructed in a manner that will "guard against waste and contamination of the ground-water resources of the state of Idaho." Rules and Regulations, Well Construction Standards, Rule 3.1.1. Mine facilities which use cyandie to process ore must be able to assure that discharges do not violate the surface or ground water quality standards. IDAPA §§ 16.01.13200.01-02.

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

An operator must submit a reclamation plan that includes a description of foreseeable, site-specific impacts from acid rock drainage and the best management practices that will be used to mitigate the impacts from the acid rock drainage. Idaho Code § 47-1506(1)(viii).

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Idaho must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

Operators must use best management practices to design, construct and maintain non-point source sediment controls to achieve state water quality standards and protect existing beneficial uses of adjacent surface waters. IDAPA § 20.03.02140.01. Similar efforts must be made at the close of each operating season. If water runoff from affected lands results in siltation of surface waters in excess of that which normally results from runoff, the operator must prepare affected lands and adjoining lands as necessary to meet state water quality standards. IDAPA § 20.03.02140.01.

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

Mine operators must remove available topsoil or other growth medium before an area is disturbed and, if topsoil or overburden removal exposes areas to potential erosion, the Department of Lands can require the use of best management practices to prevent violation of water quality standards. IDAPA § § 20.03.02140.01.a, and 03.a. Topsoil, or other growth medium, must be stockpiled in a manner minimizing rehandling and exposure to excessive wind and water erosion including the use of vegetation, silt fences, chemical binders, seeding, and mulching or other methods to control erosion. IDAPA § 20.03.02140.03.b. Abandoned affected lands must be topped with topsoil or other growth medium to achieve a general stable uniform thickness. Excessive compaction of topsoil is to be avoided and topsoil redistribution must be timed "so that seeding, or other protective measures, can be readily applied to prevent compaction and erosion." IDAPA § 20.03.02140.03.d.

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

Mine operators must revegetate mined areas, overburden piles, and abandoned roads, Idaho Code § 47-1509(a)(8), by planting species "which can be expected to result in vegetation comparable to the vegetation which was growing on the area occupied by the affected lands" prior to surface mining operations. Idaho Code § § 47-1510, IDAPA § 20.03.02140.10a. Introduced species may be planted if they are known to be comparable to previous vegetation, or if known to be of equal or superior use for the approved post-mining land use of the affected land or, if necessary, to achieve a quick, temporary cover for soil stabilization purposes. IDAPA § 20.03.02140.10.c. Revegetative success must be measured against the existing vegetation on the site before mining, or against an adjacent reference area supporting similar types of vegetation, and must be sufficient to control erosion. IDAPA § 20.03.02140.10.b. Planting should be done in a manner that promotes "rapid stabilization of the soil surface." IDAPA § 20.03.02140.10.e. Seeding and planting of affected lands should be conducted during the first normal period for favorable planting conditions after final seedbed preparation. IDAPA § 20.03.02140.09.a. The performance bond cannot be released completely until after revegetation activities have been completed consistent with the reclamation plan. IDAPA § 20.03.02120.09.

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

The Idaho Department of Fish and Game comments on all applications for an approved reclamation plan and for permits to use cyanide. Abandoned exploration drill holes must be plugged or otherwise left so as to eliminate hazards to animals. IDAPA § 20.03.02060.07.a. Tailings ponds must be reclaimed so that they will not pose a hazard to animal life. Idaho Code § 47-1509(a)(9).

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

Roads must be constructed to minimize erosion. IDAPA § 20.03.02140.04.a. All access and haul roads must be adequately drained. IDAPA § 20.03.02140.04.b. Abandoned roads must be cross-ditched as needed to avoid erosion gullies and be revegetated. Idaho Code § 47-1509(a)(5), IDAPA § 20.03.02140.04.e. The Idaho Surface Mining Act and implementing regulations prohibit the release of the entire amount of a performance bond until final removal of equipment and structures related to the mining activity. IDAPA § 20.03.02120.09.c.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

Drill holes are to be plugged or otherwise left so as not to pose a hazard to humans or animals. Idaho Code § 47-1509(a)(6), IDAPA § 20.03.02060.07.a Wells must be filled as required to stop the upward or downward movement of water. Rules and Regulations, Well Construction Standards, Rule 3.12.1.

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

All waste piles and depressions must be reduced to the lowest practicable grade of natural stability for the waste. IDAPA § 20.03.02140.05.b. Wastes not used in backfilling must be transported and placed in a sloped, naturally stable area. IDAPA § 20.03.0214006. These wastes must be compacted and should be covered and graded to allow surface drainage and ensure long-term stability. IDAPA § 20.03.02140.05.

A proposed reclamation plan must identify the location of all tailings ponds, pits, mineral stockpiles, and overburden piles. IDAPA § 20.03.02070.03. Tailings ponds must be reclaimed so that they will not pose a hazard to human or animal life. Idaho Code § 47-1509(a)(9). Wastes not used in backfilling must be transported and placed in a sloped, naturally stable area. IDAPA § 20.03.02140.06.a. These wastes must be compacted and should be covered and graded and allow surface drainage and ensure long-term stability. IDAPA § 20.03.02140.06.c. All surface water flows should be diverted and drained from the waste piles. IDAPA § 20.03.02140.06.b. A mine operator may use terraces to stabilize the face of any fill and must ensure the diversion and drainage away from the fill material of surface water. IDAPA § 20.03.02140.06.d, e. Revegetation must be conducted on the waste piles. IDAPA § 20.03.02140.06.f.

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

All mining operations must take "all reasonable precautions to prevent the generation of fugitive dust." IDAPA § 16.01.1251. Abandoned affected lands must be topped with topsoil or other growth medium "to achieve a general stable uniform thickness." IDAPA § 20.03.02140.03.d. Operators must use mulch or annual grains on areas with severe slopes "to aid in the stabilization of soil and soil moisture conservation." IDAPA § 20.03.02140.10.i. Backfill materials should be compacted to ensure stability. IDAPA § 20.03.02140.03.e.

A proposed reclamation plan must detail, on a drainage control map, the best management practices to be used to minimize erosion to affected lands. IDAPA § 20.03.02070.04.b. At reclamation, mine operators must level (1) ridges of overburden so that such ridges have a minimum width of 10 feet at the top, Idaho Code § 47-1509(a)(1), and (2) peaks of overburden so that such peaks have a minimum width of 15 feet at the top. Idaho Code § 47-1509(a)(2), IDAPA § 20.03.02140.03. Overburden piles "must be reasonably prepared to control erosion" using best management practices. Idaho Code § 47-1509(a)(3), IDAPA § 20.03.02140.03.c. Abandoned affected lands must be topped to the extent "that such overburden is reasonably available from the pit, with that type of overburden, which is conducive to control of erosion or the growth of vegetation." Idaho Code § 47-1509(a)(7), IDAPA § 20.03.02140.03.d. All waste piles and depressions must be reduced to the lowest practicable grade of natural stability for the waste. IDAPA § 20.03.02140.05.b. A reclamation plan must include scaled cross-sections showing planned surface profiles before and after mining and reclamation. IDAPA § 20.03.02070.04.a.

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

Prior to conducting any surface mining operations an operator must submit a bond in an amount determined by the Board to be the estimated reasonable costs of reclamation. In lieu of any bond an operator may deposit cash and governmental securities with the Board. Idaho Code § 47-1512(a). The performance bond will not exceed $2,500 per acre unless the Board determines that a greater amount is necessary and gives the operator notice of the determination and an opportunity for a hearing. Idaho Code § 47-1512(c). The State Board of Land Commissioners can request the State attorney general to institute proceedings to have the performance bond of an operator who fails to comply with an administrative order issued under the Surface Mining Act forfeited. Idaho Code § 47-1513(b), IDAPA § 20.03.02160.02. If a performance bond is forfeited, the State Board of Land Commissioners is authorized to reclaim the affected land. Idaho Code § 47-1505(a)(5). IDEQ also administers bonds to assure neutralization of waste, according to the rules governing ore processing by cyanidation.

INSPECTION [*Proposed* 43 CFR 3809.600]

Idaho's regulatory agencies coordinate with the federal agencies and with each other to inspect all surface mining operations at reasonable times. Idaho Code § 47-1505(a)(4), IDAPA § 20.03.02160.01. IDEQ possesses similar inspection authorities to enforce Idaho's air, water and solid waste program, Idaho Code § 39-108.2.b, including mining facilities which use cyanide to process ore. IDAPA § 16.01.13500.06.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

The Surface Mining Act authorizes formal complaints against mine operators who fail to comply with the provisions of Surface Mining Act and corrective action orders to remedy such noncompliance. Idaho Code § 47-1513(a), IDAPA § 20.03.02.003.02. The Department of Lands can issue administrative orders for noncompliance, IDAPA § 20.03.02.003.04, and institute proceedings to have the operator's performance bond forfeited. IDAPA § 20.03.02160.02. IDEQ possesses authority to enter into consent orders with recipients of notice of violations to remedy the damage caused by the violation of Idaho air, water or solid waste laws. Idaho Code § 39-108.3.a.

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

The State Board of Land Commissioners is authorized to cancel an approved reclamation plan for violations of the Surface Mining Act if the alleged violator fails to respond to a formal complaint about the violation. Idaho Code § 47-1513(a). Permits for the use of cyanide at mining facilities can be revoked for material violations of the permit or governing regulations. IDAPA § 16.01.13850.01.

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

The Surface Mining Act authorizes injunctive relief against any operator conducting surface mining operations without posting a performance bond or any operator violating an approved reclamation plan when the performance bond will be inadequate to reclaim the land if forfeited. Idaho Code § 47-1513(d), (e), IDAPA § 20.03.02160.05. Injunctions also are authorized to enjoin violations of an approved plan if "immediate and irreparable injury, loss, or damage to the state may be expected to occur." IDAPA § 20.03.02160.05. Injunctive relief may be sought to enjoin any violation of the provisions of the Surface Mining Act, or regulations or orders issued thereunder. Idaho Code § 47-1513(f). IDEQ can seek injunctions for violations of the Idaho Environmental Health Act. Idaho Code § § 39-108.8, 109. The Surface Mining Act authorizes suits for damages from an operator who violates the terms of a reclamation plan. Idaho Code § 47-1513(e). IDEQ can seek to recover any expenses incurred in enforcing Idaho Environmental Health Act or terminating any source of environmental degradation or health hazard against the alleged violator. Idaho Code § § 39-108.6, 109. Other suits for damages are governed by common law. The state may sue to recover natural resource damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. 42 U.S.C. § 9607(f).

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

Criminal misdemeanor penalties of up to $5,000 or one year imprisonment, or both, can be assessed for knowing and willful violations of the Surface Mining Act. Idaho Code § 47-1513(g), IDAPA § 20.03.02160.06.b. Willful or negligent violations of the provisions of the Idaho Environmental Health Act, or the terms of any notice, order, permit, standard, rule or regulation issued in accordance with any such law are misdemeanors punishable by fines up to $10,000 for each separate violation or $1,000 per day for continuing violations, which ever is greater. Persons who knowingly violate air quality permit provisions are guilty of misdemeanors punishable by a fine of not more than $10,000 for each separate violation or for each day of a continuing violation. Some air quality violations are also punishable by fines up to $250,000 per day or imprisonment up to 15 years. Such violations by an organization incur fines up to $1,000,000. Idaho Code § 39-117.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

If an operator lacks a performance bond or acts in a manner not provided for in the approved reclamation plan, civil penalties in an amount determined by the Board to be the anticipated cost of reasonable reclamation may be assessed. Idaho Code § 47-1513(c), (d), IDAPA § 20.03.02160.04. Additionally, penalties up to $2,500 per day of violation may be assessed for any violation of the Surface Mining Act or regulations, or orders issued thereunder. Idaho Code § 47-1513(f), IDAPA § 20.03.02160.06.a. Failure to comply with applicable well construction standards or allowing a well to cause waste or contamination of the State's ground water are grounds for the imposition of civil penalties. Rules and Regulations, Well Construction Standards, Rule 8. IDEQ can assess, or seek through a civil enforcement action, civil penalties for violations of Idaho environmental laws, including the cyanidation rules and regulations. Civil penalties up $10,000 per violation or $1,000 for each day of a continuing violation, which ever is greater, may be assessed. For air quality violations, $10,000 for each separate violation and each day of continuing air violation may be assessed. Idaho Code § § 39-108.5, 109.

CITIZEN SUITS [No provision in proposed rule]

Citizen suits are not authorized by the Idaho Surface Mining Act or the Idaho Environmental Health Act. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

MONTANA

The Montana Department of Environmental Quality (DEQ) has primary responsibility for the regulation of mining operations and reclamation activities. DEQ administers the Montana Metal Mine Reclamation Act (MMRA), Mont. Code Ann. § § 82-4-301 - 362, Mont. Admin. R. 17.24.101-189. An operating permit is required for "mining, ore processing or reprocessing of tailings or waste material, [to] construct or operate a hard-rock mill, [to] use cyanide ore-processing reagents, or [to] disturb land in anticipation of those activities."[2] Mont. Code Ann. § 82-4-335(1). An operating permit cannot be issued without an approved reclamation plan, Mont. Code Ann. § 82-4-335(4), which will include substantive reclamation standards an operator must meet at the time of reclamation. DEQ considers wetland identification to be part of the required baseline information necessary to develop an adequate reclamation plan. Reclamation must occur as specified in the approved reclamation plan unless written approval of a change of plan is received from the DEQ. Mont. Code Ann. § 82-4-336(2). The MMRA requires reclamation activities to be conducted simultaneously with operations and must be completed within a specified reasonable length of time. Mont. Code Ann. § 82-4-336(1), Mont. Admin. R. 17.24.115(18). An applicant for an operating permit must provide a performance bond in an amount set by DEQ.[3] Mont. Code Ann. § 82-4-338. Mining operations also must comply with the Montana Water Quality Act, Mont. Code Ann. § § 75-5-101 - 641, and the Clean Air Act of Montana, Mont. Code Ann. § § 75-2-101 - 429, also administered by the DEQ.

AIR QUALITY [*Proposed* 43 CFR 3809.4209(b)(1)]

The Clean Air Act of Montana, Mont. Code Ann. § § 75-2-101 - 429, and implementing regulations, Mont. Admin. R. 17.8, apply to mining operations. An air quality permit must be obtained from DEQ if emissions of any air pollutant (other than lead) from a new mine property, including fugitive dust, exceeds 25 tons per year. All mine operators must use "reasonable precautions" to control fugitive dust emissions. Mont. Admin. R. 17.8.308. MMRA regulations require mine operators to use "proper precautions" to assure that "exposed cuts and tailings or spoil disposal areas will not be subject to wind erosion to the extent that air-borne detritus becomes a public nuisance or detriment to the flora and fauna of the area." Mont. Admin. R. 17.24.115(13). Air quality requirements are part of Montana's State Implementation Plan (SIP) required by the federal Clean Air Act and Montana's implementation of the permit requirements of Title V of the Clean Air Amendments of 1990. 42 U.S.C. § 7410 (State Implementation Plans); 42 U.S.C. § 7661 (Title V Operating Permit Requirements).

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

An applicant for an operating permit must provide ground and surface water hydrologic data characterizing the hydrologic regime of the area. Mont. Code Ann. § 82-4-335(4)(k). Operators of mills must describe the methods by which surface and ground water will be restored or maintained to meet state water quality standards. Mont. Admin. R. 17.24.169(1)(d). The Montana Water Quality Act is applicable to both surface and ground water and requires mine operators to comply with the Act's nondegradation policy, and requires that discharges to state waters comply with standards and appropriate permit conditions. Mont. Code Ann. § 75-5-303. The MMRA requires that all discharges from abandoned open pits greater than two acres in size must be consistent with the requirements of the Montana Water Quality Act, with such effluents meeting water quality standards. Mont. Admin. R. 17.24.151. Montana's Water Quality Act requires that discharges to state waters must comply with standards and appropriate permit conditions.

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Mine operators must obtain a Montana Pollutant Discharge Elimination System (MPDES) permit from DEQ for all discharges into surface waters from point sources. Mont. Code Ann. § 75-5-401, Mont. Admin. R. 17.30.1201. DEQ may impose monitoring requirements in an MPDES permit. Mont. Code Ann. § 75-5-602. MPDES permit holders must comply with the State's nondegradation policy and surface water quality standards. Mont. Code Ann. § 75-5-303, Mont. Admin. R. 17.30.601.

---

[2] Small miners who qualify for a small miner exclusion in the MMRA must obtain an operating permit for that portion of any operation where a cyanide ore processing reagent will be used or disposed. Mont. Code Ann. § 82-4-305(7), Mont. Admin. R. 17.24.185.

[3] The MMRA also requires an applicant for an operating permit to certify that the applicant is not in violation of any Montana or federal environmental or mining law. Mont. Code Ann. § 82-4-335(9).

389

GROUND WATER [*Proposed* 43 CFR 3809.420(B)(2)(ii)]

Discharges to ground water are regulated by provisions contained in operating permits issued under the MMRA. Mine operators must comply with the State's nondegradation policy and ground water quality standards. Mont. Code Ann. § 75-5-303, Mont. Admin. R. 17.30.1011, 1503. DEQ may require ground water monitoring information, if the mine operation causes or is likely to cause violations of ground water quality standards. Mont. Admin. R. 17.30.1022. Reclamation plans must provide for permanent landscaping and contouring to "minimize" the amount of precipitation infiltrating into disturbed areas, including "tailings impoundments and waste rock dumps" and "measures to prevent objectionable post-mining groundwater discharges." Mont. Code Ann. § 82-4-336(10). The MMRA requires that all discharges from abandoned open pits greater than two acres in size must be consistent with the requirements of the Montana Water Quality Act, with such effluents meeting water quality standards. Mont. Admin. R. 17.24.151.

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

In order to prevent acid drainage or sedimentation, a reclamation plan must provide for earth dams or other devices to control water drainage. Mont. Admin. R. 17.24.115(4). DEQ requires permittees to submit information adequate to determine the potential for acid generation. Acid rock drainage must be controlled in a manner that assures non-degradation of surface and ground waters. When mining activities will leave an open pit exceeding two acres of surface area and the composition of the floor or walls of the pit are likely to cause formation of acid, toxic, or otherwise pollutive solutions on exposure to moisture, the reclamation plan must include adequate control measures to prevent or mitigate acid generation and migration. Mont. Code Ann. § 82-4-336(5), Mont. Admin R. 17.24.151. The reclamation plan must provide measures to prevent objectionable post-mining groundwater discharges. Mont. Code Ann. § 82-4-336(1). Where operations result in the need to prevent acid drainage or sedimentation, on or in adjoining lands or streams, reclamation plans must include reasonable devices to control water drainage. Mont. Admin. Code § 17.24.115(4). Montana control efforts include capping and redirecting drainage to ensure that post-mining geochemical rates of change are minimized. Water treatment is considered as a contingency plan, to be bonded if site conditions warrant, and then to be implemented if necessary. Monitoring is required to document that water quality standards are met, to document geochemical changes, and to document that any special handling (of materials) requirements have been met. Monitoring is tailored to site-specific conditions.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Montana must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

DEQ considers wetland identification (including function and values) to be a part of the required baseline information necessary to develop an adequate reclamation plan. DEQ defers to the Corps of Engineers for reclamation standards. The MMRA regulations require that, after reclamation, water be diverted or treated to control siltation, erosion, and other water pollution. Mont. Admin. R. 17.24.115(7). Reclamation plans also must provide for surface water diversions to prevent water pollution and unnecessary erosion. Mont. Admin. R. 17.24.115(15).

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

To be approved, a reclamation plan must provide for the stockpiling and reuse of soils from all disturbed areas, where practicable. Mont. Admin. R. 17.24.115(2). DEQ reclamation plan guidelines recommend that an applicant for an operating permit submit the following information for both subsoil and topsoil: (1) replacement volumes; (2) average replacement depths; (3) soil amendments (*e.g.*, fertilizer, lime, mulch); (4) scarification prior to topsoil replacement; (5) grading techniques/compaction; and (6) special handling techniques.

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

Reclamation plans must provide for vegetative cover appropriate to the post-mining use of the affected land. Mont. Code Ann. § 82-4-336(6). Revegetation must begin as quickly as possible in a manner consistent with accepted agricultural and reforestation practices. All fill and cut slopes must be revegetated, along with all drill sites and spoils from discovery pits or other excavations and the exploration road. Mont. Admin. R. 17.24.107, 17.24.104. If revegetation is unsuccessful, the operators must make a second attempt consistent with the advice of the Board of Environmental Review. Mont. Admin. R. 17.24.115(3). Revegetation must be accomplished in the first appropriate season after necessary grading in accordance with accepted agricultural or reforestation practices. Mont. Admin. R. 17.24.115(18).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

An applicant for an operating permit must provide data on wildlife in the area to be disturbed relevant to the proposed post-mining land use. Mont. Admin. R. 17.24.115(1)(c).

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

Roads must be located, constructed, and maintained to control and minimize channeling and other erosion. Mont. Admin. R. 17.24.115(8). Operators of permitted mills, which includes "any facility for ore, tailings, or waste rock processing and disposal," Mont. Admin. R. 17.24.165(6), must remove facilities. Mont. Admin. R. 17.24.165(8), 17.24.169(1)(f). Facility is defined as "any building, impoundment, embankment, waste or tailings disposal site, or other man-made structure associated with a particular activity." Mont. Admin. R. 17.24.165(5).

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

The first 25 feet of all adits must be backfilled. Shafts must be backfilled. Mont. Admin. R. 17.24.107(6). All exploration drill holes must be plugged at the surface. Mont. Admin. R. 17.24.106.

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

Reclamation plans must provide for permanent landscaping and contouring to minimize the amount of precipitation that infiltrates into disturbed areas, including tailings impoundments and waste rock dumps. Mont. Code Ann. § 82-4-336(10). Operators must detail in reclamation plans the method of disposing of mining debris, including mill tailings, and the location and size of such disposal areas. Mont. Admin. R. 17.24.115(14). Operators of permitted mills, which includes "any facility for ore, tailings, or waste rock processing and disposal," Mont. Admin. R. 17.24.165(6), must remove facilities. Mont. Admin. R. 17.24.165(8), 17.24.169(1)(f). Facility is defined as "any building, impoundment, embankment, waste or tailings disposal site, or other man-made structure associated with a particular activity." Mont. Admin. R. 17.24.165(5). DEQ regulations require "leaching pads, tailing ponds, or water, waste, or product holding facilities [to] be constructed, operated, and maintained" so as to prevent pollution discharge, seepage, drainage, or infiltration. Mont. Admin. R. 17.30.637(4).

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

DEQ regulations implementing the Clean Air Act of Montana require mine operators to use "reasonable precautions" to control fugitive dust emissions. Mont. Admin. R. 17.8.308. MMRA regulations require mine operators to use "proper precautions" to assure that "exposed cuts and tailings or spoil disposal areas will not be subject to wind erosion to the extent that air-borne detritus becomes a public nuisance or detriment to the flora and fauna of the area." Mont. Admin. R. 17.24.115(13). The MMRA requires reclamation of all disturbed land to "comparable utility and stability as that of adjacent areas, except for open pits and rock faces which may not be feasible to reclaim in the same fashion as other disturbed land." Mont. Code Ann. § 82-4-336(7). Reclamation plans must demonstrate that upon partial or complete saturation graded fill, tailings, or spoil slopes will be stable, and grading must provide for adequately designed contour trenches, benches, and rock-lined channelways on disturbed areas. Mont. Admin. R. 17.24.115(2). Reclamation plan guidelines require a monitoring program to establish post-reclamation soils and geologic stability with respect to wind erosion, soil loss, and subsidence.

A reclamation plan must provide for permanent landscaping and contouring to "minimize" the amount of precipitation infiltrating into disturbed areas, including "tailings impoundments and waste rock dumps." Mont. Code Ann. § 82-4-336(10). Operators of mills must grade the slopes of materials potentially acid or toxic-forming to prevent future erosion of such materials offsite. Mont. Admin. R. 17.24.169(1)(b). Final grading must be performed with non-noxious, nonflammable, noncombustible solids unless approval has been granted for a supervised sanitary fill. Mont. Code Ann. § 82-4-336(4), Mont. Admin. R. 17.24.115(12). Exploration activities must be reclaimed in a manner consistent with the provisions of the MMRA and implementing regulations. Mont. Code Ann. § 82-4-332, Mont. Admin. R. 17.24.103. All drill sites and spoils from discovery pits or other excavations and the exploration road must be revegetated. Mont. Admin. R. 17.24.107(4).

PIT RECLAMATION [*Proposed* 43 CFR 3809.420(c)(7)]

Where mining has left an open pit exceeding two acres of surface area and the composition of the floor or walls of the pit are likely to cause the formation of acid, toxic, or otherwise pollutive solutions on exposure to moisture, the reclamation plan must provide for (1) the insulation of all faces from moisture or water contact by covering to a depth of two feet or more with material or fill not susceptible to generation of such objectionable effluents; and (2) the processing or evaporation in the pit or drainage to settling or treatment basins of such objectionable effluents to safe levels before release. Mont. Code Ann. § 82-4-336(5). In the case of open pits and rock faces, the reclamation plan must provide for reclamation to a condition of stability structurally competent to withstand geologic and climatic conditions without significant failure that would be a threat to public safety and the environment. Mont. Code Ann. § 82-4-336(7). The MMRA requires reclamation of all disturbed land to "comparable utility and stability as that of adjacent areas, except for open pits and rock faces which may not be feasible to reclaim in the same fashion as other disturbed land." Mont. Code Ann. § 82-4-336(7).

SOLID WASTE [*Proposed* 43 CFR 3809.420(c)(8)]

Mine operators must comply with solid waste disposal requirements "in a manner that will prevent water pollution or deleterious effects upon revegetation efforts." Mont. Admin. R. 17.24.115(6).

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

Permit applicants must file a performance bond in an amount determined by DEQ of not less than $200 or more than $2,500 for each acre of disturbed land. In lieu of a bond, applicants may file a cash deposit, an assignment of a certificate of deposit, or other surety acceptable to DEQ. Regardless of the per-acre limitations, the bond may not be less than the estimated cost to the state to implement the closure plan. Mont. Code Ann. § 82-4-338(1), Mont. Admin. R. 17.24.140. DEQ must review the amount of each bond at least every five years and modify the bond requirement if it determines that the bond level should be adjusted. Mont. Code Ann. § 82-4-338(2), Mont. Admin.

R. 17.24.141. A bond cannot be released until the permit provisions have been fulfilled. Mont. Code Ann. § 82-4-338(3). If an operator fails to comply with the terms of a notice of noncompliance or an order suspending the operating permit within the time limits set forth in the notice or order, the performance bond can be forfeited. Mont. Code Ann. § 82-4-9362(2).

INSPECTION [*Proposed* 43 CFR 3809.600]

DEQ must inspect a proposed mine site before issuing an operating permit. Mont. Code Ann. § 82-4-337(1)(d). Once permitted, DEQ must inspect mining operations at least annually and at least once per quarter for each active operation that uses cyanide, or that must be monitored for acid rock drainage, or exceeds 1,000 acres of permitted area. Mont. Code Ann. § 82-4-341(1), Mont. Admin. R. 17.24.128. Inspections may result from a citizen complaint. Mont. Admin. R. 17.24.129. DEQ is authorized to conduct compliance inspections at "any reasonable time" under the Montana Water Quality Act. Mont. Code Ann. § 75-5-603, and the Montana Clean Air Act. Mont. Code Ann. § 75-2-403.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

DEQ can issue notices of noncompliance and orders suspending operating permits. These notices of noncompliance and orders must specify in what respects the operator has failed to comply with the MMRA and must order abatement within a specified time period. Mont. Code Ann. §82-4-362(1), Mont. Admin. R. 17.24.132, 133, 136. DEQ also can issue noncompliance notices and orders under the Montana Water Quality Act. Mont. Code Ann. § 75-5-611, 613, and the Montana Clean Air Act. Mont. Code Ann. § 75-2-401. An order issued as part of a notice or after a hearing may prescribe the date by which the violation must cease, time limits for ordered corrective actions to be taken, or dates by which penalties must be paid.

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

DEQ may issue an order suspending an operating permit for violations of the MMRA, MMRA implementing regulations, or permit provisions. Mont. Code Ann. § 82-4-362(1), Mont. Admin. R. 17.24.133. If the operator fails to comply with the terms of the suspension order, the operating permit can be revoked. Mont. Code Ann. § 82-4-362(2). DEQ also can suspend or revoke any permit issued under the Montana Water Quality Act, Mont. Code Ann. § 75-5-401, 613, and the Montana Clean Air Act. Mont. Code Ann. § 75-2-401.

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

DEQ can seek a restraining order or a temporary or permanent injunction for violating or threatening to violate an order issued under the MMRA. Mont. Code Ann. § 82-4-361(2). DEQ can seek to enjoin activities violating the Montana Water Quality Act, Mont. Code Ann. § 75-5-614, and the Montana Clean Air Act. Mont. Code Ann. § 75-2-412(4). A property owner who uses ground water may bring an action for damages against a mining operation that diminishes the quality or quantity of the water supply, after pursuing administrative remedies with the DEQ. Mont. Code Ann. § 82-4-355. Other suits for damages are governed by common law. The state may sue to recover natural resource damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. 42 U.S.C. § 9697(f).

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

The MMRA does not authorize criminal penalties. Criminal penalties of fines up to $25,000 per day of violation or up to one year in prison are authorized under the Montana Water Quality Act. Second offenses subject a person to fines up to $50,000 per day of violation or up to two years in prison. Mont. Code Ann. § 75-5-632. The Montana Clean Air Act, Mont. Code Ann. § 75-2-412(1) authorizes criminal penalties for violations of the Act, including fines up to $10,000 per violation or imprisonment for up to two years, or both.

393

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

Civil penalties of up to $1,000 per day per violation can be assessed for violations of the MMRA, MMRA implementing regulations, or operating permits. Mont. Code Ann. § 82-4-361(1). If a violation creates an imminent danger to the health or safety of the public or causes significant environmental harm, the maximum penalty is $5,000 for each day of violation. Mont. Code Ann. § 82-4-361(1)(b). DEQ can seek civil penalties of up to $25,000 per day under the Montana Water Quality Act, Mont. Code Ann. § 75-5-631, and $10,000 per day ($80,000 maximum) under the Montana Clean Air Act. Mont. Code Ann. § 75-2-413.

CITIZEN SUITS [No provision in proposed rule]

The MMRA authorizes citizen suits for an action of mandamus by "any person having an interest that is or may be adversely affected" against the state for failure to enforce the MMRA, after notification of the state of such failure. Mont. Code Ann. § 82-4-354. The MMRA also authorizes citizen suits to compel performance directly against a violator if the DEQ fails to act. Mont. Code Ann. § 82-4-354(3). The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

NEVADA

The Division of Environmental Protection (DEP) in the Nevada Department of Conservation and Natural Resources regulates mining operations, including reclamation. DEP administers the following major statutory authorities which apply to mining:

- The Nevada Reclamation Law, Nev. Rev. Stat. Ch. 519A, Nev. Admin. Code ch. 519A
- The Water Pollution Control Law, Nev. Rev. Stat §§ 445.131.354, Nev. Admin. Code §§ 445.070-174, 242-24388
- Solid and hazardous waste management laws, Nev. Rev. Stat. §§ 444.440 -.465, Nev. Admin. Code §§ 444.570 -.7499 (statute and regulations governing solid waste disposal), Nev. Rev. Stat. §§ 459.400 -.600, Nev. Admin. Code §§ 444.850 -.8746 (statute and regulations governing hazardous waste management)
- The Air Pollution Control Law, Nev. Rev. Stat. §§ 445.401-710, Nev. Admin. Code §§ 445.430.

Nevada's Reclamation Law requires mining operators to obtain an operating permit before conducting a mineral exploration project, Nev. Rev. Stat. § 519A.180, or a mining operation. Nev. Rev. Stat. § 519A.200. An operating permit cannot be issued without an approved reclamation plan. Nev. Rev. Stat. § 519A.190, Nev. Admin. Code § 519A.125 (exploration), Nev. Rev. Stat. § 519A.210, Nev. Admin. Code § 519A.140 (mining). In addition, a permit will not become effective until a surety is filed with DEP or the federal land manager in an amount sufficient to ensure reclamation of the entire site. Nev. Rev. Stat. § § 519A.190.5, 210.5, Nev. Admin. Code §§ 519A.350, 360. In order to obtain a permit under the Nevada Reclamation Law, an operator must agree in writing to be responsible for the reclamation of any land damaged as a result of the exploration or mining operation. Nev. Rev. Stat. §§ 519A.190.3, 519A.210.3. The reclamation activities must be "economically and technologically practicable in achieving a safe and stable condition" suitable for the selected productive post-mining use of the land. Nev. Rev. Stat. § 519A.230.4

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Mine operators must comply with the Nevada Air Pollution Control Law, Nev. Rev. Stat. §§ 445.401-710, and implementing regulations. Nev. Admin. Code §§ 445B.001 - .395. An operating permit must be obtained if emissions are expected and throughout exceeds 50lbs/hour. Nev. Admin. Code §§ 445B.287, .303. Fugitive dust at mine sites must be controlled. Nev. Admin. Code § 445B.365. Ambient air quality standards must be met at the site boundary. Air quality requirements are part of Nevada's State Implementation Plan (SIP) required by the federal Clean Air Act, and Nevada's implementation of the permit requirements of Title V of the Clean Air Amendments of 1990. 42 U.S.C. § 7410 (State Implementation Plans); 42 U.S.C. § 7661 (Title V Operating Permit Requirements).

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

All mines with the potential to degrade waters of the State must be permitted. Nev. Admin. Code § 445A.424. An application for a Nevada mining facility permit must include hydrogeological and lithological information that describes the subsurface of the site. Nev. Admin. Code § 445A.395. In addition, an applicant must submit a fluid management plan, a monitoring plan, and a draft closure plan. Nev. Admin. Code §§ 445A.397, .398. Mine facilities must be designed to protect surface and ground waters from degradation below state and federal water quality standards. Nev. Admin. Code §§ 445A.424. Mine operators may be required to reclaim (1) roads and drill pads by restoring or stabilizing drainage areas or streambeds, (2) solution ponds, settling ponds, and other or tailings impoundments by restoring the surface water regime existing before the disturbance, and (3) open pit mines by creating a lake for recreation, wildlife or other uses. Nev. Admin. Code § 519A.345.

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Mine operators must obtain a National Pollutant Discharge Elimination System (NPDES) permit from DEP for point source discharges to surface water. Nev. Admin. Code § 445A.228. Additionally, Nevada has promulgated separate and additional permitting requirements for mines with the potential to degrade surface or ground water. Nev. Admin. Code §§ 445A.350 - .447. Mine facilities cannot cause the degradation of surface water below state water quality standards. Nev. Admin. Code § 445A.424. Additionally, "process components" typically must meet a "zero-discharge" design standard, and any component containing process fluids must be designed with liners or other engineered containment features. Nev. Admin. Code §§ 445A.385, .432 - .439. Water pollution control permits require the monitoring of surface and ground water "which may be affected by the facility." Nev. Admin. Code § 445A.440. At closure, a mine operator must demonstrate that the facility no longer has any potential to degrade surface or ground water. Nev. Admin. Code §§ 445A.430, .431, .446. Monitoring of surface and ground water quality must continue after closure of the facility. Nev. Admin. Code § 445A.446.

GROUND WATER [*Proposed* 43 CFR 3809.420(B)(2)(ii)]

Nevada has promulgated permitting requirements for mines with the potential to degrade surface or ground water. Nev. Admin. Code §§ 445A.350 - .447. Mine facilities cannot cause the degradation of ground water below federal and state drinking water quality standards. Nev. Admin. Code § 445A.424. Additionally, "process components" typically must meet a "zero-discharge" design standard, and any component containing process fluids must be designed with liners or other engineered containment features. Nev. Admin. Code §§ 445A.385, .432 - .439. Water pollution control permits require the monitoring of ground water "which may be affected by the facility." Nev. Admin. Code § 445A.440. At closure, a mine operator must demonstrate that the facility no longer has any potential to degrade ground water. Nev. Admin. Code §§ 445A.430, .431, 446. Monitoring of ground water quality must continue after closure of the facility. Nev. Admin. Code § 445A.446.

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

Nevada's water quality permitting requirements – which are designed to prevent degradation of waters of the State – provide the authority to impose controls on acid generation. Nev. Admin. Code §§ 445A.350 - .447. DEP requires operators to develop and carry out a sampling program before and during mine operations to identify the potential for acid generation. Waste Rock and Overburden Evaluation Policy, Bureau of Mining Regulation and Reclamation, Nevada DEP (September 14, 1990). The program must be "representative," taking into account lithological, mineralogical and color variation, extent of sulfides and oxidation and other factors. *Id.* Operators must use static and kinetic testing methods to assess acid generation potential. *Id.*at page 2. If acid generation potential is identified, whether before operations begin or during operations, the operator must develop neutralization and containment methods and propose them to DEP for approval. *Id.* At least two years before closure of a process component is contemplated, the operator must update its closure plans in a "Final Permanent Closure Plan." Preparation Requirements and Guidelines, Permanent Closure Plans and Final Closure Reports, Bureau of Mining Regulation and Reclamation (September 1, 1994). The Closure plan must address how waste rock, mine pits, and other features will be stabilized to prevent degradation of waters of the State. *Id.* at page 8. When closure is complete, the operator must submit a "Final Closure Report" which demonstrates that waste rock, pits and other features have been stabilized and do not have the potential to degrade waters of the State. *Id.* at page 9.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Nevada must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

A reclamation plan must detail the "methods of drainage that will be used during the mining operation and reclamation," Nev. Rev. Stat. § 519A.220.1(g), and "measures to be taken to minimize loading of sediments to surface water during the operation and reclamation." Nev. Admin. Code § 519A.270.12.

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

Reclamation plans must include a plan for the "management of topsoil and growth medium." Nev. Admin. Code § 519A.270.13(a). Topsoil is defined as "the material at or near the surface of the earth which has been modified and acted upon by natural, physical, chemical or biological agents in a manner which will allow it to support vegetation." Nev. Admin. Code § 519A.095. If practicable and necessary for the establishment of the post-mining land use, sufficient topsoil, if available, must be removed form the affected land before disturbing and stockpiled for use in reclamation. The stockpile must be stabilized to prevent excessive losses from wind and water erosion. If topsoil is unavailable, any growth medium to be used at reclamation that requires removal and stockpiling must be managed in the same manner as topsoil. Nev. Admin. Code § 519A.325.1.

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

Reclamation plans must include a revegetation strategy for disturbed lands. Nev. Rev. Stat. §§ 519A.20[illegible].(h), 230.1(b), Nev. Admin. Code § 519A.270.13. A mine operator must establish plant species which will result in vegetation productivity comparable to that existing before the mining operation began. Nev. Admin. Code § 519A.330. DEP may require revegetation for roads and drill pads, waste piles, tailings dams and ponds, and heap leach pads. Nev. Admin. Code § 519A.345.

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

A mine operator "which develops or maintains an artificial body of water containing chemicals directly associated with the processing of ore" must obtain a permit from the Nevada Department of Wildlife. Nev. Rev. Stat. § 502.390. The permit will specify measures and operating standards that protect wildlife. Nev. Admin. Code §

502.480. Any wildlife mortality must be reported to the Department of Wildlife. Nev. Admin. Code § 502.485. Upon closure, impoundments must be neutralized, or fenced and covered.

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

A reclamation plan must outline the proposed disposition of buildings and equipment, Nev. Admin. Code § 519A.270.14, or describe any surface facilities, including roads and buildings, not to be reclaimed. Nev. Admin. Code § 519A.270.15. DEP may require a mine operator to reclaim buildings, foundations, facilities, structures and other equipment by (1) demolishing to the level of the foundation and burying the demolished items on the site or disposed off-site, (2) salvaging and sale, or (3) continuing to use in a manner consistent with the post-mining land use. Nev. Admin. Code § 519A.345.8. DEP may require revegetation and reclaiming of roads by ripping or scarifying the surface, constructing water bars, or restoring drainage areas or streambeds. Nev. Admin. Code § 519A.345.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

Well drillers must take "every reasonable precaution" to prevent contamination of an aquifer. Nev. Admin. Code § 534.370. DEP may require revegetation for drill pads or reclaiming by ripping or scarifying the surface, constructing water bars, or restoring drainage areas or streambeds. Nev. Admin. Code § 519A.345. Upon abandonment, wells, including those drilled during a mining operation or exploration, must be backfilled or plugged if the well does not reach ground water, or plugged and cement grouted. Nev. Admin. Code § 534.421. All wells must be plugged as soon as possible. Nev. Admin. Code § 534.425. In addition, for purposes of determining the amount of the surety required by the Nevada Reclamation Law, mine operators must notify DEP of the "average number of drill holes to be left open at any one time during the life of the project." Nev. Admin. Code § 519A.140.2(g). Reclamation must be accomplished in a way that "ensure[s] public safety," including the sealing or securing of shafts, tunnels and adits and the plugging of drill holes. Nev. Admin. Code § 519A.315 (see also Nev. Admin. Code § 513.390 for acceptable methods of securing mine shafts and openings).

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

DEP may require a mine operator to regrade waste rock piles to reduce erosion and enhance stability and divert surface water runon to reduce erosion; regrade tailings impoundments and heap leach pads to promote surface water runoff and reduce surface water infiltration and runon; and to revegetate waste piles, tailings dams and ponds, and heap leach pads. Nev. Admin. Code § 519A.345.

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

Under the Nevada Air Pollution Control Act, fugitive dust must be controlled during mining operations and reclamation activities. Nev. Admin. Code § 445B.365. DEP may require a mine operator to grade waste rock piles to reduce erosion and enhance stability. Nev. Admin. Code § 519A.345. A reclamation plan must include information on the post-mining topography, including detailing "the treatment of slopes" and "technical criteria used to determine the final gradient and stability of slopes" created or affected by the mining operation. Nev. Rev. Stat. § 519A.220.1(d), Nev. Admin. Code § 519A.270.7, .8. At abandonment, reclaimed sites must be in a "safe and stable condition suitable for the productive post-mining use of the land" including slopes in a structurally stable condition. MLRA regulations define "stable condition" as "resistant to excessive erosion" and "structurally competent to withstand normal geologic and climatic conditions without significant failure that would be a threat to public safety and the environment." Nev. Admin. Code § 519A.315. DEP may require a mine operator to restore or stabilize drainage beds. Nev. Admin. Code § 519A.345.

Reclaimed land must be "resistant to excessive erosion," Nev. Admin. Code § 519A.315, and land subject to excessive erosion will not be considered to be reclaimed. Nev. Admin. Code § 519A.275.4. DEP may require a mine operator to (1) reclaim roads and drill pads by ripping or scarifying the surface, constructing water bars, or restoring drainage areas or streambeds, (2) regrade grade waste rock piles and divert surface water runon to reduce erosion, (3) regrade tailings impoundments and heap leach pads to promote surface water runoff and reduce surface water infiltration and runon, and (4) approximate the form of the land before disturbance. Nev. Admin. Code § 519A.345.

PIT RECLAMATION [*Proposed* 43 CFR 3809.420(c)(7)]

Mine operators may be required to reclaim open pit mines by creating a lake for recreation, wildlife or other uses. Nev. Admin. Code § 519A.345.

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

The MLRA requires that surety be provided in an amount sufficient to ensure reclamation of the entire area to be affected by the mine project. Nev. Admin. Code § 519A.350, .360. The amount of the surety must be at least the cost of the reclamation if conducted by the state and/or federal agency with jurisdiction over the land. Nev. Admin. Code § 519A.360.2. The MLRA authorizes the forfeiture of surety if a mining operation has been completed, abandoned, or temporarily closed for a period greater than that allowed by the permit without initiating reclamation. The surety also may be forfeited if the reclamation permit is suspended or revoked. Nev. Admin. Code § 519A.390. The surety may be released when all of the requirements of the reclamation have been fulfilled, except that the State must release a portion of the surety covering the reclamation of a discrete part of the disturbance or a discrete reclamation activity when that portion is completed. Nev. Admin. Code § 519A.385.

INSPECTION [*Proposed* 43 CFR 3809.600]

MLRA regulations provide for DEP inspection of mining operations, Nev. Admin. Code § 519A.395, and a site must be inspected before releasing a posted surety. Nev. Admin. Code § 519A.385.4. DEP also has inspection authority under the Water Pollution Control Law, Nev. Rev. Stat. § 445.304, and the Air Pollution Control Law. Nev. Rev. Stat. 445.581.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

DEP can issue notices of noncompliance pursuant to the MLRA. Nev. Admin. Code § 519A.400. DEP also can issue compliance orders for violations of the Water Pollution Control Law, Nev. Rev. Stat. § 445A.690, or the Air Pollution Control Act. Nev. Rev. Stat. § 445B.450. DEP also can issue orders to require assessment of spills and releases of hazardous substances, pollutants and contaminants, and corrective action. Nev. Rev. Stat. §§ 459.748 - .780; Nev. Admin. Code § 445A.226 - .22755.

ENFORCEMENT – PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

DEP can suspend or revoke a reclamation permit for noncompliance with the MLRA, implementing regulations, or an approved reclamation plan. Nev. Admin. Code § 519A.220. DEP can modify, revoke or suspend permits issued under the Water Pollution Control Law for violations of permit terms and for obtaining a permit by misrepresentation. Nev. Rev. Stat. § 445A.600, Nev. Admin. Code § 445A.387.3. The Air Pollution Control Law also provides for revocation. Nev. Rev. Stat. § 445B.300.2; Nev. Admin. Code § 445B.325.

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

DEP may seek injunctive relief for violations of the Water Pollution Control Law, or standards, regulations, or permits thereunder. Nev. Rev. Stat. § 445A.695. DEP possesses similar authority under the Air Pollution Control Law. Nev. Rev. Stat. §§ 445B.460. DEP can collect "actual damages" resulting from violations of the Water Pollution Control Law, including expenses incurred in performing remediation and compensation for loss of wildlife, fish or aquatic life. Nev. Rev. Stat. § 519A.331. Other suits for damages are governed by common law. The state may sue to recover natural resource damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. 42 U.S.C. § 9607(f).

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

Any violation of the MLRA constitutes a misdemeanor. Nev. Rev. Stat. § 519A.280. Mine operators who fail to obtain a wildlife permit from the Department of Wildlife for bodies of water containing chemicals or abide by such a permit are guilty of a misdemeanor. Nev. Rev. Stat. § 502-390.5. The Water Pollution Control Law authorizes criminal penalties for defendants who acted "intentionally or with criminal negligence" in violating the Act, Nev. Rev. Stat. § 445A.705. The Air Pollution Control Law also provides for criminal penalties. Nev. Rev. Stat. § 445B.470.4.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

The MLRA authorizes civil penalties in addition to, or in lieu of, criminal penalties. Nev. Rev. Stat. § 519A.280, Nev. Admin. Code § 519A.405. The Water Pollution Control Law authorizes the assessment of civil penalties either administratively by DEP or by a court for violations of the Law, or permits, standards, regulations, or final orders thereunder. Nev. Rev. Stat. § 445A.331. Civil penalties – including administrative penalties – also are authorized by the Air Pollution Control Law. Nev. Rev. Stat. § 445B.500, .640.

CITIZEN SUITS [No provision in proposed rule]

Citizen suits are not authorized by the MLRA or other Nevada state environmental statutes. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

NEW MEXICO

In New Mexico, mining activities are regulated by: the Mining and Minerals Division (MMD) in the Energy, Minerals and Natural Resources Department, which regulates operational and reclamation activities; the Department of the Environment, which regulates air, ground water, and surface water quality; and the State Engineer's Office, which regulates water quantity. MMD administers the New Mexico Mining Act (NMMA) which became effective on June 18, 1993.[4] N.M. Stat. Ann. § § 69-36-1-20. "Existing mining operation" means an extraction operation that produced marketable minerals for a total of at least two years between January 1, 1970, and June 18, 1993. N.M. Stat. Ann. § 69-36-3.E. A "new mining operation" is one that engages in a development or extraction operation after June 18, 1993, and is not an existing mine. N.M. Stat. Ann. § 69-36-3.I. All requirements listed below which cite N.M. Stat. Ann. § 69-36-7.H apply to new mines only.

After June 18, 1993, new mining operations in New Mexico must obtain an operating permit from MMD. N.M. Stat. Ann. § 69-36-12. Both new and existing mining operations were required to submit to MMD, by June 30, 1994, either a site assessment, which described existing state and federal permits and regulatory requirements and provided other environmental data, or a notice of intent to close. N.M. Stat. Ann. § 69-36-5. New mining operations cannot receive an operating permit without an approved reclamation plan and posted financial assurance. N.M. Stat. Ann. § 69-36-7.H, I, Q. The New Mexico Mining Commission created by the NMMA, N.M. Stat. Ann. § 69-36-6, promulgated regulations to implement the terms of the NMMA on July 12, 1994. More detailed requirements for most of the topics listed below are found in these regulations, called the NMMA Rules ("Rules"). In addition to the requirements imposed by the NMMA, mining operations must comply with the New Mexico Water Quality Act, N.M. Stat. Ann. § § 74-6-1 - 17, and the New Mexico Air Quality Control Act, N.M. Stat. Ann. § § 74-2-1 - 17, administered by the Environment Department.

---

[4] The NMMA defines "reclamation" as:

> the employment during and after a mining operation of measures designed to mitigate the disturbance of affected areas and permit areas and to the extent practicable, provide for the stabilization of a permit area following closure that will minimize future impact to the environment from the mining operation and protect air and water resources.

N.M. Stat. Ann. § 69-36-3.K.

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Mining operations must comply with the New Mexico Air Quality Control Act, N.M. Stat. Ann. § § 74-2-1 - 17, and implementing regulations, Air Quality Control Regulations, administered by the New Mexico Department of the Environment. The Department of the Environment issues construction and operating permits for mining facilities which emit air pollutants, including fugitive dust. Air quality requirements are part of New Mexico's State Implementation Plan (SIP) as required by the federal Clean Air Act, and New Mexico's implementation of the permit requirements of Title V of the Clean Air Amendments of 1990. 42 U.S.C. § 7410 (State Implementations Plans); 42 U.S.C. § 7661 (Title V Operating Permit Requirements).

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

The NMMA requires that new mining operations incorporate measures to reduce, to the extent practicable, the formation of acid and other toxic drainage that may otherwise occur following closure and which would cause federal or state water quality standards to be exceeded. N.M. Stat. Ann. § 69-36-7.H(5). All mining operations must comply with the State's antidegradation policy and the New Mexico Standards for Interstate and Intrastate Streams. NMWQCC.

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

A key provision of the NMMA requires that mining operations demonstrate that their activities will not cause federal or state water quality standards to be exceeded. N.M. Stat. Ann. § 69-36-7.P (2). Mining operations with point source discharges to surface water must obtain a National Pollutant Discharge Elimination System (NPDES) permit from the U.S. Environmental Protection Agency. 42 U.S.C. § 1342. MMD cannot completely release a new operator's financial assurance so long as the lands to which the release would apply are contributing suspended solids above background levels to the streamflow of intermittent and perennial streams. N.M. Stat. Ann. § 69-36-7.R. (1).

GROUND WATER [*Proposed* 43 CFR 3809.420(B)(2)(ii)]

Mining operations, including processing facilities, with the potential to discharge to ground water must have a ground water discharge plan approved by the New Mexico Department of the Environment.[5] NMWQCC Water Quality Regs. § § 3104, 3106. A ground water discharge plan must provide for ground water monitoring, including monitoring after closure, NMWQCC Water Quality Regs. § 3107, and compliance with ground water protection standards. NMWQCC Water Quality Regs. § 3103. The Department of the Environment possesses the authority to require a surface mining operation to submit an environmental closure plan and financial assurance before approving a ground water discharge plan, NMWQCC Water Quality Regs. § 3107.

---

[5] A mining operation, without processing facilities or catchment ponds without the potential to create a hazard, does not need to have an approved ground water discharge plan. NMWQCC Water Quality Regs. § 3-3105.(H). (Exemption for "leachate which results from the direct natural infiltration of precipitation through disturbed materials, unless the [Department of the Environment] determines that a hazard to public health may result.")

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

The NMMA requires that new mining operations incorporate measures to reduce, to the extent practicable, the formation of acid and other toxic drainage that may otherwise occur following closure and which would cause federal or state water quality standards to be exceeded. N.M. Stat. Ann. § 69-36-7.H(5). Surface runoff from nonpoint sources containing acid or other toxic substances must be contained within the permit area. N.M. Stat. Ann. § 69-36-7.H (6). Closure plans must detail site specific conditions including depth to ground water, concentration of contaminants, and acid-generating potential of waste material. A mining material sampling program must be approved by the Department of the Environment which characterizes waste material potential contamination concerns and assesses control measures needed for closure. Static and /or kinetic testing is required to predict acid generation potential, and an assessment of oxygen migration may be required. The closure plan must include engineered design drawings, technical specifications, and quality assurance plans for control of acid generation, control of acid rock drainage migration and collection and treatment of acid rock drainage once it has migrated. Post closure monitoring and a contingency plan for the remediation of ground water that exceeds New Mexico Water Quality Control pollutant standards is required.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, New Mexico must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

Mine operators must take measures to preserve topsoil from erosion or contamination and assure that the topsoil is in a useable condition for sustaining vegetation when needed. N.M. Stat. Ann. § 69-36-7.H (8).

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

MMD must retain, for revegetated areas, the amount of financial assurance necessary for a third party to reestablish vegetation for a period of 12 years after the last year of augmented seeding, fertilization, irrigation, or other work, unless the post-mining land use is inconsistent with the further need for revegetation. N.M. Stat. Ann. § 69-36-7.R (1). Mine operators must attain, in the permit area, "a self-sustaining ecosystem appropriate for the life zone of the surrounding areas following closure unless conflicting with the approved post-mining land use." N.M. Stat. Ann. § 69-36-7.H (4). Topsoil must be preserved from contamination and erosion so that it is in a useable condition for sustaining vegetation. N.M. Stat. Ann. § 69-36-7.H (8).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

The NMMA Rules contain provisions which assure the protection of the environment and wildlife and the establishment of a self-sustaining ecosystem. N.M. Stat. Ann. § 69-36-7.H (2) (4).

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

The removal of buildings, equipment or structures at closure must be in accord with the approved closeout or reclamation plan as developed under the NMMA and Rules.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

Mine discovery or drill holes that encounter ground water must be plugged, or otherwise constructed, maintained, and operated so that any water encountered is permanently confined to the aquifer. State Engineer Regs. § 4-21.

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

The NMMA requires that "all waste, waste management units, pits, heaps, pads and any other storage piles [be] designed, sited and constructed in a manner that facilitates, to the maximum extent practicable, contemporaneous reclamation." N.M. Stat. Ann. § 69-36-7.H (7). These waste areas must be reclaimed to meet the general standards imposed by the NMMA and Rules.

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.402(c)(6)]

To the extent practicable, a mine operator must stabilize a permit area following closure to minimize future impact to the environment from the mining operation and protect air and water resources. N.M. Stat. Ann. § 69-36-3.K. This obligation includes minimizing fugitive dust emissions from the mining operation. N.M. Stat. Ann. § 74-2-7B. The NMMA requires backfilling or partial backfilling only when necessary to achieve reclamation objectives that cannot be achieved through other mitigation measures. N.M. Stat. Ann. § 69-36-7.H (3).

MAINTENANCE AND PUBLIC SAFETY [*Proposed* 43 CFR 3809.420(c)(10)]

Upon abandonment, a mine operator must effectively close or fence all surface openings through which a person could enter. N.M. Stat. Ann. § 69-27-3.

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

A permit applicant must file financial assurance prior to issuance of a permit. The amount of financial assurance shall be sufficient to assure completion of the performance requirements of the permit, including closure and reclamation, if the work had to be performed by the State or a third party. The amount of financial assurance must be periodically reviewed for inflationary increases and changes in reclamation and closure costs. Financial assurance cannot duplicate or be less comprehensive than federal financial requirements and cannot include any type or variety of self-guarantee or self-insurance. N.M. Stat. Ann. § 69-36-7.Q.

The Rules provide that if a permittee refuses or is unable to conduct or complete the reclamation or closeout plan, if the terms of the permit are not met, or if the permittee defaults on the conditions under which the financial assurance was accepted, the Director shall take action to forfeit all or part of the financial assurance. 19 NMAC 10.2.1211.A. Water Quality regulations require that each discharge plan approved by the Department of the Environment must include a closure plan with financial assurances. NMWQCC Water Quality Regs. § 3107.

INSPECTION [*Proposed* 43 CFR 3809.600]

MMD must inspect an active mining operation at least twice a year and a mining operation conducting significant reclamation activities once a month. Inactive sites will be inspected at least once per year. N.M. Stat. Ann. § 69-36-7.S. Before releasing any portion of a permittee's financial assurance, MMD must inspect the reclaimed mine site. N.M. Stat. Ann. § 69-36-7.R. The New Mexico Department of the Environment also possesses inspection authorities under the Water Quality Act, N.M. Stat. Ann. § 74-6-9.E, and the Air Quality Control Act. N.M. Stat. Ann. § 74-2-13.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

The NMMA authorizes the Director of MMD to issue cessation orders for acts which will cause a significant imminent environmental harm or an abatement order for violations of the NMMA which will not cause a significant imminent environmental harm. N.M. Stat. Ann. § 69-36-7.S (3), (4). The Director can issue an order to show cause as to why a permit should not be suspended or revoked when the Director finds a pattern of violations of the NMMA are willful violations or are caused by a permittee's unwarranted failure to comply with the act. N.M. Stat. Ann. § 69-36-7-S. (5). The New Mexico Department of the Environment also can issue compliance orders, including cease and desist and abatement orders, under the Water Quality Act, N.M. Stat. Ann. § 74-6-10, and § 74-6-11.B, and the Air Quality Control Act. N.M. Stat. Ann. § 74-2-12.A.

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

A mining operation permit can be suspended or revoked for a violation of a permit condition or an NMMA statutory or regulatory provision. N.M. Stat. Ann. § 69-36-12.C. The New Mexico Department of the Environment also can suspend or revoke permits issued under the Water Quality Act, N.M. Stat. Ann. § 74-6-5.L, and § 74-6-10.B, or the Air Quality Control Act. N.M. Stat. Ann. §§ 74-2-10.B, 12.B.

ENFORCEMENT -- SUIT FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

The MMD can seek to have court enforcement of a cessation or abatement order issued by the Division. N.M. Stat. Ann. § 69-36-7.S (3), (4). The New Mexico Department of the Environment is authorized to seek injunctive relief against any violator of the Water Quality Act, N.M. Stat. Ann. § 74-6-10.A, and § 74-6-11.A, and air pollutant sources presenting an imminent and substantial endangerment to the public health or welfare or the environment under the New Mexico Air Quality Control Act. N.M. Stat. Ann. §§ 74-2-10.A, 12.A(2). The New Mexico Natural Resources Trustee Act, N.M. Stat. Ann. § § 75-7-1 - 5, establishes a natural resources trustee whose responsibilities include recovering damages "for injury to, destruction of or loss" of New Mexico's natural resources. N.M. Stat. Ann § 75-7-3.A. Damage awards will include "the cost of restoration, replacement or acquisition of equivalent resources, plus compensation for the loss of use or enjoyment of the natural resources" and reimbursement of the state's enforcement expenses. N.M. Stat. Ann. § 75-7-4. Other suits for damages are governed by common law. The state may sue to recover natural resource damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. 42 U.S.C. § 9607(f).

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

Any person who knowingly or willfully violates the NMMA, or regulations, orders or permits issued pursuant to the NMMA is guilty of a misdemeanor. Criminal penalties can include a fine not to exceed $10,000 per day of violation or imprisonment of up to one year, or both. N.M. Stat. Ann. § 69-36-18. Criminal acts defined in the Water Quality Act are all punishable felonies, N.M. Stat. Ann. § 74-6-10.2. The Air Quality Control Act, N.M. Stat. Ann. § 74-2-14, provides for misdemeanor and felony penalties that range from fines of $10,000 to $250,000 and/or six months to nine years imprisonment.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

Civil penalties up to $10,000.00 per day of noncompliance, may be assessed for violations of the NMMA, or regulations, orders, or permits issued pursuant to the NMMA. N.M. Stat. Ann. § 69-36-17. The Water Quality Act and the Air Quality Control Act authorize the New Mexico Department of the Environment to assess civil penalties

403

up to $15,000 per day of non-compliance per violation, N.M. Stat. Ann. § § 74-6-5.P, 10.A,C. N.M. Stat. Ann. § § 74-2-12.B, 12.1.

CITIZEN SUITS [No provision in proposed rule]

The NMMA authorizes citizen suits against (1) the New Mexico Department of Environment, New Mexico Energy, Minerals and Natural Resources Department, or the New Mexico Mining Commission for violations of the of the NMMA or for failing to perform a nondiscretionary act or duty under NMMA or (2) any violator of a rule, regulation, order, or permit issued pursuant to NMMA. N.M. Stat. Ann. § 69-36-14. No citizens suits are allowed under the Water Quality Act or Air Quality Control Act. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

OREGON

Mining activities, including reclamation, are regulated by the Oregon Department of Geology and Mineral Industries (DOGAMI). DOGAMI administers the Oregon Mined Land Reclamation Act (MLRA). Or. Rev. Stat. §§ 517.750-900, Or. Admin. R. ch. 632, div. 37. The MLRA requires an operating permit issued by DOGAMI for all surface mining operations. Or. Rev. Stat. § 517.790(1). An operating permit cannot be issued without an approved reclamation plan and the filing of a performance bond or security deposit with DOGAMI. Or. Rev. Stat. §§ 517.790(2) and 517.810. The MLRA imposes more stringent requirements for chemical process mines, defined as a mining or processing operation for metal-bearing ores that uses chemicals to dissolve metals from ore. Or. Rev. Stat. §§ 517.952-989. Chemical process mines must use best available, practicable, and necessary technology to assure compliance with environmental standards. Or. Rev. Stat. 517.956(1). Mining operations also must comply with the Oregon Water Pollution Control Law, Or. Rev. Stat. §§ 468B.005-500, and the Oregon Air Pollution Control Law, Or. Rev. Stat. §§ 468A.005-992, administered by the Oregon Department of Environmental Quality (DEQ).

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Mining operations must comply with the Oregon Air Pollution Control Law, Or. Rev. Stat. §§ 468A.005-992, administered by the Oregon DEQ. DEQ issues construction and operating permits for mining operations that emit air pollutants, including fugitive dust. Or. Rev. Stat. § § 468A.310 - 330. As a condition in all operating permits, operators must protect off-site flora or fauna from fugitive dust. Air quality requirements are part of Oregon's State Implementation Plan (SIP) required by the federal Clean Air Act. 42 U.S.C. § 7410.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

An operating plan must include a "process water budget analysis" and surface water management procedures to ensure against ground water contamination. Or. Admin. R. 632-37-060(5), (8). Reclamation and closure plans must contain procedures for ore storage sites and tailings disposal facilities to meet decommissioning performance standards to protect air quality, surface and ground water quantity and quality, and living resources, and for the appropriate isolation or removal of waste material. Or. Admin. R. 632-37-070(12).

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

A National Pollutant Discharge Elimination System (NPDES) permit, issued by the DEQ, is required for any discharge from a point source at a mine site during operations or reclamation into surface waters. Or. Rev. Stat. § 468B.050. Mine operators must comply with the State's surface water quality standards. Or. Admin. R. 340-041-0001 - 0975.

GROUND WATER [*Proposed* 43 CFR 3809.420(B)(2)(ii)]

Chemical process mines must use best available, practicable, and necessary technology to assure compliance with environmental standards. Or. Rev. Stat. § 517.956(1). An operating plan must include a "process water budget analysis" and surface water management procedures to ensure against ground water contamination. Or. Admin. R. 632-37-060(5), (8). Reclamation and closure plans must contain procedures for ore storage sites and tailings disposal facilities to meet decommissioning performance standards for the protection of air quality, surface and ground water quantity and quality, and living resources, and for the appropriate isolation or removal of waste material. Or. Admin. R. 632-37-070(12). Mine operators must comply with the State's nondegradation policy for ground water, Or. Rev. Stat. § 468B.155, and ground water quality protection rules. Or. Admin. R. 340-040-0001-0135.

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

DOGAMI may require that an operator specify in the operating plan a list and procedures for the handling and storage of acid-forming materials generated from or required for mining or processing at the proposed operation. Or. Admin. R. 632-35-025(2)(c)(Q). An operating plan also must include a "process water budget analysis" and surface water management procedures to ensure against ground water contamination. Or. Admin. R. 632-37-060(5), (8). Reclamation and closure plans must include a characterization and management plan for all wastes, including the quantity and quality of such wastes. Or. Admin. R. 632-37-070(4). Reclamation and closure plans must contain procedures for ore storage sites and tailings disposal facilities to meet decommissioning performance standards to protect surface and ground water quantity and quality, and living resources, and for the appropriate isolation or removal of waste material. Or. Admin. R. 632-37-070(12).

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Oregon must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

A reclamation and closure plan must provide for the rehabilitation or restoration of affected stream channels and stream banks to maximize water retention and minimize bank erosion, channel scour, siltation, and increased water temperature. Or. Admin. R. 632-37-070(6).

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

A reclamation and closure plan must detail procedures for the salvage, storage, and replacement of topsoil or acceptable substitute and recontouring, stabilization, and topsoil replacement of all disturbed areas. Or. Admin. R. 632-37-070(1), (2).

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

A reclamation and closure plan must contain provisions for the revegetation of all disturbed areas consistent with the establishment of a self-sustaining ecosystem comparable to undamaged ecosystems in the area of the mine. Or. Admin. R. 632-37-070(3). Vegetation includes seedbed preparation, mulching, fertilizing, species selection, and seeding and planting rates and schedules. Or. Admin. R. 632-37-070(3). During revegetation, operators must use native species and comply with other requirements imposed by DOGAMI. Or. Admin. R. 632-37-130(5), (6).

Revegetation will be considered successful if such revegetation is comparable in stability and utility to adjacent analogous areas. Or. Admin. R. 632-37-130(4).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

Chemical process mining operations must: (1) comply with protection measures for fish and wildlife promulgated by the State Department of Fish and Wildlife; (2) maintain an objective of zero wildlife mortality, including covering or containing processing solutions and associated waste water to preclude access to wildlife; (3) take onsite and offsite mitigation measures to ensure no overall net loss of habitat; (4) ensure no loss of existing critical habitat of any state or federally threatened or endangered species; and (5) report fish and wildlife mortality. Or. Rev. Stat. § 517.956(2). Surface reclamation of a chemical process mine must assure protection of fish and wildlife, and be certified by the State Department of Fish and Wildlife that the reclamation establishes a self-sustaining ecosystem consistent with the permittee's habitat restoration obligations. Or. Rev. Stat. § 517.956(3). A consolidated application for a permit to operate a chemical process mining operation must include a fish and wildlife protection and mitigation plan. Or. Rev. Stat. § 517.971(7)(d).

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

A reclamation and closure plan must detail procedures for removing and disposing of all equipment, refuse, structures and foundations. Or. Admin. R. 632-37-070(10). Only permanent structures authorized to remain after closure in the approved reclamation plan can remain after reclamation. Or. Admin. R. 632-37-130(11).

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

DOGAMI regulates all exploration activities, including the abandonment of exploration drill holes. Or. Admin. R. ch. 632, div. 33. All exploration drill holes must be abandoned in a manner so as to (1) prevent loss of quality and minimize, to the greatest extent practicable, loss of quantity to surface and ground waters and prevent interaquifer mixing, and (2) prevent aquifer contamination from surface drainage. Or. Admin. R. 632-33-025(7)(e)(A). Abandonment must occur in a manner consistent with procedures set out in MLRA implementing regulations. Or. Admin. R. 632-33-025(7)(e)(B). Exploration areas, including surface openings, must be reclaimed in a manner consistent with MLRA implementing regulations. Or. Admin. R. 632-33-010(12).

ACID-FORMING, TOXIC, OR OTHER DELETERIOUS MATERIALS. [*Proposed* 43 CFR 3809.420(c)(3)]

DOGAMI may require that an operator specify in the operating plan a list and procedures for the handling and storage of acid-forming materials generated from or required for mining or processing at the proposed operation. Or. Admin. R. 632-35-025(2)(c)(Q). Chemical process mines must use best available, practicable, and necessary technology to assure compliance with environmental standards. Or. Rev. Stat. § 517.956(1).

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

Reclamation and closure plans must include a characterization and management plan for all wastes, including the quantity and quality of such wastes. Or. Admin. R. 632-37-070(4). Reclamation and closure plans also must contain procedures to ensure that ore storage sites meet decommissioning performance standards intended to protect air quality, surface and ground water quantity and quality, and living resources, and for the appropriate isolation or removal of waste material. Or. Admin. R. 632-37-070(12). Post-closure monitoring is required to ensure compliance with decommissioning performance standards. Or. Admin. R. 632-37-130(3).

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

As a condition in all operating permits, operators must protect off-site flora or fauna from fugitive dust. A reclamation and closure plan must detail procedures for the recontouring, stabilization, and topsoil replacement of all disturbed areas. Or. Admin. R. 632-37-070(2). All final slopes must be stable, blend with adjacent terrain, and be compatible with the establishment of a self-sustaining ecosystem. Or. Admin. R. 632-37-130(7).

A reclamation and closure plan must provide for recontouring, stabilization, topsoil replacement, and the establishment of required slopes. Or. Admin. R. 632-37-070(8). All final slopes must be stable, blend with adjacent terrain, and be compatible with the establishment of a self-sustaining ecosystem. Or. Admin. R. 632-37-130(7). Reclaimed cutbanks must not have slopes exceeding 1.5:1, though exceptions for steeper slopes may be allowed if they will be stable and the steeper slopes blend into adjacent terrain features, existed prior to mining, or are consistent with the establishment of a self-sustaining ecosystem comparable to undamaged ecosystems in the area of the mine. Or. Admin. R. 632-37-130(8). Fill slopes must be 2:1 or flatter unless steeper slopes are approved. Or. Admin. R. 632-37-130(9).

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

An applicant for a mining permit must file a bond or security deposit in an amount determined by DOGAMI, not to exceed the total cost for reclamation if the department were to perform the reclamation. Or. Rev. Stat. § 517.810. In addition, for chemical process mines a bank financial security may be required to deal with the credible accident. The MLRA authorizes DOGAMI to recover the costs of reclamation from the performance bond or security deposit posted with DOGAMI if the permittee fails to complete reclamation. Or. Rev. Stat. § 517.860.

INSPECTION [*Proposed* 43 CFR 3809.600]

DOGAMI must inspect a proposed mine site prior to issuing an operating permit. Or. Rev. Stat. § 517.830(1). The MLRA also authorizes DOGAMI to conduct inspections at reasonable times after advance notice has been given to the permittee. If the department has reason to believe that the provisions of an operating permit are being violated or that a mining operation is being conducted without a permit, the department may inspect without prior notice. Or. Rev. Stat. §§ 517.850, 930. DOGAMI must inspect an exploration area to ensure compliance with the terms of an exploration permit prior to releasing the financial security for such area. Or. Admin. R. 632-33-045. The State Department of Fish and Wildlife is authorized to inspect chemical process mines with an operating permit containing permit conditions to protect fish and wildlife. Or. Rev. Stat. § 517.988(2). The Oregon DEQ also possesses inspection authority at all reasonable times to enforce the provisions of the Water Pollution Control Law and the Air Pollution Control Law. Or. Rev. Stat. § 468.095.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

DOGAMI can order an operator to suspend operations if the operator is conducting a surface mining operation without a valid operating permit or violating permit conditions. Or. Rev. Stat. § 517.880. DOGAMI may order civil penalties for violations of MLRA statutory or regulatory provisions, an operating permit, or orders which involves a chemical process mine. Or. Rev. Stat. § 517.992. DOGAMI also can issue closure orders for violations of the exploration regulations. Or. Admin. R. 632-33-025(11). The Oregon DEQ can issue similar administrative orders to enforce the provisions of the Water Pollution Control Law and the Air Pollution Control Law. Or. Rev. Stat. § 468.035(j).

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

The MLRA authorizes permit revocations for failure to pay civil penalties. Or. Rev. Stat. § 517.992(8), Or. Admin. R. 632-37-150(8). DOGAMI can revoke exploration permits through the issuance of a Closure Order. Or. Admin. R. 632-33-040. The Oregon DEQ can modify, suspend, or revoke permits issued under the Water Pollution Control

Law or Air Pollution Control Law for material misrepresentations or false statements in a permit application, failing to comply with permit conditions, or violating statutory or regulatory requirements or an administrative order. Or. Rev. Stat. § 468.070(1).

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

DOGAMI can seek to have the Attorney General enjoin surface mining operations being conducted in violation of an administrative order to suspend operations, Or. Rev. Stat. § 517.880, or exploration activities being conducted in violation of an administrative closure order. Or. Admin. R. 632-33-025(11)(b). The Oregon DEQ can seek equitable remedies, including temporary or permanent injunctions, to enforce compliance with, and restrain further violations of, the Water Pollution Control Law and Air Pollution Control Law. Or. Rev. Stat. § 468.100(1). The Oregon Water Pollution Control Law imposes strict liability upon any person responsible for the injury, death, contamination, or destruction of fish or wildlife, or injury or destruction of fish or wildlife habitat, caused by pollution. The State of Oregon can recover the value of the fish or wildlife so injured or destroyed and for all costs of restoring fish and wildlife production in the affected areas, including habitat restoration. Or. Rev. Stat. § 468B.060. Other suits for damages are governed by common law. The state may sue to recover natural resource damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. 42 U.S.C. § 9607(f).

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

Criminal penalties in the form of fines up to $1,000 ($10,000 for a nonaggregate surface mining operation) may be assessed under the MLRA for operating a surface mining operation without an operating permit, violating the conditions of an operating permit, or violations of MLRA statutory or regulatory provisions. Or. Rev. Stat. § 517.990. Criminal penalties also are authorized for violations of the Water Pollution Control Act and the Air Pollution Control Act. Or. Rev. Stat. §§ 468.920-963, which include fines up to $200,000. Each day a violation occurs is a separate punishable offense. The crime of environmental endangerment incurs imprisonment of up to 15 years and/or fines up to $2,000,000. Subsequent convictions incur imprisonment up to 30 years and/or fines up to $5,000,000. Or. Rev. Stat. § 468.951

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

Civil penalties of not less than $200 per day and not more than $50,000 per day may be assessed for violations of MLRA statutory or regulatory provisions, an operating permit, or an order which involves a chemical process mine. Or. Rev. Stat. § 517.992, Or. Admin. R. 632-37-150. Civil penalties up to $10,000 per day can be assessed for violations of the Water Pollution Control Law and Air Pollution Control Law. Or. Rev. Stat. §§ 468.130, 140, 996. Additionally, persons who intentionally or recklessly violate the Water Pollution Control Law or the Air Pollution Control Law may incur civil penalties up to $100,000 if the violation creates the imminent likelihood for an extreme hazard to the public health or causes extensive damage to the environment. Or. Rev. Stat. § 468.996.

CITIZEN SUITS [No provision in proposed rule]

The MLRA does not authorize citizen suits. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

SOUTH DAKOTA

Mining activities, including reclamation, are regulated by the South Dakota Department of Environment and Natural Resources (DENR) which is overseen by the Board of Minerals and Environment. S.D. Codified Laws § 1-40-25. DENR administers the Mined Land Reclamation Act (MLRA). S.D. Codified Laws ch. 45-6B, S.D. Admin. R. 74:29, the Mineral Exploration Act, S.D. Codified Laws ch. 45-6C, and South Dakota's Water Pollution Control

Act, S.D. Codified Laws ch. 34A-2, S.D. Admin. R. 74:50-56, and Air Pollution Control Act. S.D. Codified Laws ch. 34A-1, S.D. Admin. R. 74:36. The MLRA requires all mine operators to obtain a mining permit from DENR. S.D. Codified Laws § 45-6B-5,78. A mining permit cannot be issued without an approved reclamation plan, S.D. Codified Laws § § 45-6B-5(2), 7, and the submission of surety in an amount necessary to guarantee the costs of reclamation. S.D. Codified Laws § § 45-6B-20, 21, 26. Also, Mine operators are required to request the department to determine whether a potential mine site exhibits special, exceptional, critical, or unique characteristics. S.D. Codified Laws § 45-6B-33.3 to 33.8, S.D. Admin. R. 74:29:10. This "Request for Determination of Special, Exceptional, Critical, or Unique Lands" is required to be submitted at least 60 days before the submittal of a mine permit application. S.D. Admin. R. 74:29:10:04(1). If proposed mine lands are found to have special, exceptional, critical, or unique characteristics, the Board of Minerals and Environment may find the lands unsuitable for mining or can impose additional restrictions on the mining operation. S.D. Codified Laws § 45-6B-33.5.

The MLRA also requires the posting of financial assurance to guarantee the costs of postclosure care and maintenance after the completion of reclamation. S.D. Codified Laws § 45-6B-91. At reclamation, mine operators must comply with the minimum reclamation standards established by the MLRA, along with state water and air quality standards. The MLRA requires concurrent reclamation during all phases of mining operations and the submission of an estimated timetable for reclamation with the reclamation plan. S.D. Admin. R. 74:29:08.

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

The South Dakota Air Pollution Control Law, S.D. Codified Laws ch. 34A-1, and implementing regulations, S.D. Admin. R. 74:36, apply to mining operations, particularly as to fugitive dust, particulates, and emissions from milling and processing operations. Air quality permits are required for mine sites that have regulated pollution sources. This permit may include addressing fugitive emissions, S.D. Admin R 74:36:65:06 (standard for issuance of operating permit). Air quality requirements are part of South Dakota's State Implementation Plan (SIP) as required by the federal Clean Air Act. 42 U.S.C. § 7410.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

During operations and reclamation, mine operators must minimize any disturbance to the prevailing hydrologic balance of the affected land and surrounding area and to the quality and quantity of surface and ground water systems. S.D. Codified Laws § 45-6B-41. To accomplish this goal mine operators must: (1) comply with South Dakota water quality and water rights laws and regulations and federal dredge and fill requirements; (2) remove temporary or large sedimentation, erosion, or drainage controls after revegetation and stabilization; (3) design permanent diversion structures not to erode; and (4) divert unchannelized surface water around the operation to minimize pollution and erosion and to protect the operation and downstream water users who have prior water rights. S.D. Admin. R. 74:29:07:08. Erosion control measures must be implemented during all phases of construction, operation, reclamation, and closure, and depressions from the accumulation of water are prohibited unless they are consistent with the approved post-mining land use. S.D. Admin. R. 74:29:07:04. Original drainages must be preserved and alternative drainages may be approved if they are functionally compatible with, and complement the prevailing hydrologic balance of the surrounding area. S.D. Admin. R. 74:29:07:04(5). DENR may require an applicant for a mining permit to submit information sufficient for DENR to determine the potential impact mining could have to the hydrologic balance of the affected land. S.D. Admin. R. 74:29:02:11. A surface and ground water monitoring plan for the life of the mine may be required. S.D. Admin R. 74:29:02:11(7).

The South Dakota Water Pollution Control Act prohibits causing, or placing wastes in a location where they are likely to cause, pollution to any waters of the state. S.D. Codified Laws § 34A-2-21. The Act also prohibits discharging any wastes which cause further reduction of water quality. S.D. Codified Laws § 34A-2-22. "Waters of the state" include both surface and ground water. S.D. Codified Laws § 34A-2-2(12). These anti-pollution and anti-degradation provisions apply to releases from mine facilities.

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

A Surface Water Discharge permit, issued by DENR, is required for any discharge from a point source at a mine site, during operations or reclamation, into surface waters of the State. S.D. Codified Laws § 34A-2-36, S.D. Admin. R. 74:52. A Surface Water Discharge permit requires surface water monitoring. S.D. Admin. R. 74:52. These monitoring requirements are integrated into hydrologic monitoring requirements of the mining permit. A Surface Water Discharge permit requires that a discharge not cause a violation of South Dakota surface water quality standards. S.D. Admin. R. 74:51. Mining operations which divert streams must ensure that water quality meets surface water quality standards. S.D. Admin. R. 74:29:07:10(6).

GROUND WATER [*Proposed* 43 CFR 3809.420(b)(2)(ii)]

A DENR issued ground water discharge permit is required for any discharges into the ground water from a surface mining operation. S.D. Codified Laws § 34A-2-36.1. The ground water discharge permit requires that the discharge not cause a violation of South Dakota ground water quality standards. S.D. Admin. R. 74:54:01, 74:54:02:06(7). The State's ground water strategy to maintain and improve ground water quality includes mineral exploration, development and mine reclamation under the MLRA and Mineral Exploration Act. S.D. Codified Laws § 34A-2-103.

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

South Dakota's regulatory approach stresses the importance of acid rock drainage (ARD) prevention from the start of operations. Prevention mechanisms are required in operating and reclamation plans to avoid acid generation problems from startup to closure. Stringent pre-mining static and kinetic predictive testing and extensive operational "in-pit" testing of mined rock, allow acid and non-acid rock to be identified early and disposed of accordingly. Ore that tests above the total sulfur cutoff is to be amended with limestone or another suitable base amendment sufficient to obtain a neutralization potential to acid generating potential ratio of at least 3 to 1. Static and kinetic testing continues throughout the life of the project and is reported annually in the water quality report. If pit highwalls are determined to be acid generating, submission of a mitigation plan for capping must be submitted. The DENR reserves the right to adjust the reclamation surety to cover backfill and capping requirements for highwalls. To the greatest extent possible, measures are to be taken to minimize the amount of acid generating rock exposed in the highwalls. Construction fill must be segregated from acid producing rock. Operators must account for the amount of non-reactive rock that will be contaminated by intermixing with acid generating rock in handling processes and DENR may require some operators to take specific measures to minimize the effects of intermixing. DENR requires operators to submit quarterly a cumulative log documenting waste rock management practices undertaken during routine mining operations during that quarter. A water treatment plant must be designed to effectively manage and treat all acid mine drainage and remain operational for as long as water treatment is required to comply with water quality limitations. Sludge disposal facilities may not be placed in an acid generating environment. Operators are required to submit to DENR conceptual contingency plans for mitigation measures in the event any completed component of a facility begins to generate acid mine drainage or the water treatment system fails. Operators must monitor surface water quality throughout the postclosure period. South Dakota includes in its permits a provision that allows postclosure financial assurances to be used to take corrective actions to mitigate acid generation problems. Operators must submit a performance monitoring plan for the postclosure period which includes monitoring measures to be used to assess control of acid generation in reclaimed facilities. Specific ARD predictive, prevention, testing, reporting, rock handling, reclamation, bonding, treatment and other requirements will vary depending on site specific conditions and ARD potential at the mine.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33

U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, South Dakota must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

For permanent or temporary diversions of intermittent and perennial streams, the stream banks must be stabilized, vegetated and protected where necessary by rock, geosynthetic liners or filter media, riprap, or similar measures to minimize erosion and degradation of surface water quality. S.D. Admin. R. 74:29:07:10(2), (3). Permanent diversions must be designed and constructed to prevent erosion and to carry flow consistent with the flow produced by the stream's original width, depth, shape and gradient. S.D. Admin. R. 74:29:07:10(3). Channel and flood plain diversions must be designed to prevent erosions during the passage of the approved design precipitation event. S.D. Admin. R. 74:29:07:10(5). In addition, surface runoff diversions around milling or processing facilities using potentially toxic chemicals or materials must be capable of carrying the flow from the six-hour probable maximum precipitation event without causing erosion and all surface runoff diversions must by capable of carrying a minimum of the two-year, six-hour precipitation event without causing erosion. S.D. Admin. R. 74:29:07:09(6), (7).

SOIL AND GROWTH MATERIALS [*Proposed* 43 CFR 3809.420(b)(4)]

All salvageable topsoil or other suitable material must be removed from the affected land before being disturbed and segregated from other spoil. Mine operators must take efforts to avoid deterioration of topsoil including: (1) using vegetative cover or other means to prevent wind and water erosion; (2) preventing contamination by other acid or toxic material; and (3) ensuring the topsoil remains in a useable condition for sustaining vegetation. If sufficient topsoil does not exist on the affected land, other suitable material such as subsoil may be used as a topsoil substitute if the material is capable of establishing and sustaining vegetation. Substituted materials must be removed, segregated, and preserved like topsoil. S.D. Codified Laws § 45-6B-40, S.D. Admin. R. 74:29:07:07. To avoid loss of topsoil by erosion, diversion ditches may not discharge on topsoil storage areas, spoil, or areas containing other unconsolidated material. S.D. Admin. R. 74:29:07:09(8). Topsoil, spoil or other unconsolidated materials may not be pushed into or placed within 10 feet of the banks of a stream or in a location which may subject them to waters from flooding. S.D. Admin. R. 74:29:07:10(1). At reclamation, topsoil must be distributed as necessary to establish and sustain the required vegetation and the reclamation plan must contain an estimate of the amount of topsoil needed to complete reclamation. S.D. Codified Laws § 45-6B-40, S.D. Admin. R. 74:29:07:07(5).

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

If reclamation will involve revegetation, the mine operator must establish "a diverse, effective and long-lasting vegetative cover that is capable of self-regeneration and at least equal in extent of cover to the natural vegetation of the surrounding area." S.D. Codified Laws § 45-6B-39. Vegetative species and composition must be appropriate for the post-mining land use and introduced, naturalized or nonnative plant species may be used only if they are suitable for post-mining land use and are approved by the Board of Minerals and Environment. S.D. Admin. R. 74:29:07:06(1). Mine operators must develop methods for revegetation which incorporate reference areas, baseline data comparisons, or other procedures to determine post-reclamation revegetation success. S.D. Admin. R. 74:29:07:06(2), (3). Seeding and planting must be done in accordance with accepted agricultural practices and affected lands must be seeded during the first normal period of favorable planting conditions after final topsoil preparation. S.D. Admin. R. 74:29:07:06(4).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

A reclamation plan must include a description of critical resources and plans for mitigating potential impacts to such critical resources. Critical resources include: critical deer winter range; threatened or endangered species and other critical wildlife resource identified by the Department of Game, Fish and Parks; and cold water fish life propagation

4/11

water. S.D. Codified Laws § 45-6B-92. During the mine planning process, MLRA regulations require the consideration of preventive measures to minimize harmful impacts to wildlife. S.D. Admin. R. 74:29:07:02(6).

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

Drainage control structures must be used in connection with roads and railroad spurs as needed to control runoff and to minimize erosion, sedimentation, and flooding. S.D. Admin. R. 74:29:07:12(5). All buildings and structures constructed, used, or improved by the operator must be dismantled and removed from the mine site unless they are consistent with the approved post-mining land use. S.D. Admin. R. 74:29:07:13. All buildings and equipment associated with a millsite also must be removed. S.D. Admin. R. 74:29:05:04.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

All underground mine openings and workings or previously existing underground mine workings intercepted by surface mining activities must be sealed during reclamation. S.D. Admin. R. 74:29:07:17. Under the South Dakota Mineral Exploration Act, reclamation is mandatory on all lands affected by mineral exploration activities, S.D. Codified Laws § 45-6C-3(1), including: the restoration of "each drill site and other affected land as nearly as possible to its original condition," S.D. Codified Laws § 45-6C-33, and the capping, sealing, and plugging of each test hole immediately following drilling and probing. S.D. Codified Laws § 45-6C-28, S.D. Admin. R. 74:11:08.

ACID-FORMING, TOXIC OR OTHER DELETERIOUS MATERIALS [*Proposed* 43 CFR 3809.420(c)(3)]

Acid-forming or toxin-producing materials that have been mined must be handled and disposed in a manner that will control unsightliness and protect the hydrologic system from pollution. S.D. Admin. R. 74:29:07:05.

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

Spoil must be located to avoid blocking intermittent or perennial drainages; permanent spoil dumps must be approved by the Board of Minerals and Environment to be stable; the mine operator must take efforts to minimize water pollution from spoil; and all spoil material that is toxic or acid-forming or that will prevent reestablishment of vegetation of the reclaimed land surface must be properly disposed of during the mining operation unless such materials occur naturally on the land surface. S.D. Admin. R. 74:29:07:14. Diversion ditches may not discharge on storage areas containing top soil, spoil, or other unconsolidated material. S.D. Admin. R. 74:29:07:09(8). All refuse from the mining operation must be disposed in a manner creating the least amount of unsightliness and unproductive areas, and which will not pollute surface or ground water. S.D. Codified Laws § 45-6B-38, S.D. Admin. R. 74:29:07:05. Upon final reclamation, all tailings impoundments not designed for retention of fluids must be free draining with drainage not causing erosion or water pollution, interfering with the postclosure monitoring system, or limiting access to the site. S.D. Admin. R. 74:29:05:05. All areas of the affected land, including spoil piles, must be stabilized so as to control erosion and possible water and air pollution, including fugitive dust. S.D. Codified Laws § 45-6B-43, S.D. Admin. R. 74:29:07:09.

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

All areas of the affected land, including spoil piles, must be stabilized during operation and reclamation activities so as to control erosion and possible water and air pollution, including fugitive dust. S.D. Codified Laws § 45-6B-43, S.D. Admin. R. 74:29:07:04. A mine operator must prevent or minimize slides, subsidence, or other damage to the mine site and surrounding area during mining and reclamation to the mine site and surrounding area. S.D. Codified Laws § 45-6B-42, S.D. Admin. R. 74:29:07:16. All highwalls which are not eliminated or reduced must be stabilized. S.D. Admin. R. 74:29:07:04(2).

4/12

Erosion control measures must be implemented during all phases of construction, operation, reclamation, and closure, and depressions for the accumulation of water are prohibited unless they are consistent with the approved post-mining land use. S.D. Admin. R. 74:29:07:04. Original drainages must be preserved as much as possible. S.D. Admin. R. 74:29:07:04(2)(4).

Diversion ditches and other surface runoff diversions must be stabilized by planting grasses and using rock, riprap, concrete, geosynthetic liners or filter media, or other methods to control erosion. S.D. Admin. R. 74:29:07:09(1), (2), (3). In addition, surface runoff diversions around milling or processing facilities using potentially toxic chemicals or materials must be capable of carrying the flow from the six-hour probable maximum precipitation event without causing erosion and all surface runoff diversions must by capable of carrying a minimum of the two-year, six-hour precipitation event without causing erosion. S.D. Admin. R. 74:29:07:09(6), (7). Diversion ditches may not discharge on storage areas containing top soil, spoil, or other unconsolidated material. S.D. Admin. R. 74:29:07:09(8).

The MLRA requires all reclaimed slopes and slope combinations to be: (1) visually and functionally compatible with the configuration of the surrounding area; (2) suitable for post-mining land use; and (3) structurally stable. S.D. Admin. R. 74:29:07:04(1). Landforms created as the result of grading, backfilling, or other topographic reconstruction of the affected land must blend in with, and complement, the visual continuity of the surrounding area. S.D. Admin. R. 74:29:07:04(7). Grading must control erosion and sedimentation, protect areas outside the affected land from slides or other damage, and minimize the need for long-term maintenance. S.D. Codified Laws §§ 45-6B-37, 42, S.D. Admin. R. 74:29:07:04(2). A reclamation plan must include grading, backfilling, and other topographic reconstruction techniques to achieve visually and functionally compatible contours. S.D. Admin. R. 74:29:07:03.

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

The Board of Minerals & Environment requires a surety to guarantee the costs of reclamation of public and private lands. S.D. Codified Laws § 45-6B-20. The amount of the surety is based on the cost of reclaiming only the extent of disturbed lands at any one time during the various stages of the mining operation. S.D. Codified Laws § 45-6B-21. The surety may be guaranteed by a corporate surety bond, cash, or government securities. S.D. Codified Laws §§ 45-6B-22, 23. The Board may require any operator whose mining operation employs cyanide leaching or any other chemical or biological leaching process to extract minerals from ore, to file additional proof of financial assurance based on the cost of responding to and remediating accidental releases of cyanide or other leaching agents into the environment. The additional financial assurance must be at least $25,000 but not more than $500,000. S.D. Codified Laws § 45-6B-20.1. Additionally, mining operations are required to do post closure monitoring and care for up to thirty years. Each mining operation must post financial assurance to guarantee the costs of postclosure care and maintenance over the postclosure period. S.D. Codified Laws § 45-6B-91.

If an operator violates a cease and desist order, the MLRA authorizes the South Dakota attorney general to institute a proceeding for forfeiture of the surety posted with the Board of Minerals and Environment. S.D. Codified Laws § 45-6B-66. If a surety is forfeited, the state is to reclaim the land in a manner consistent with the terms of MLRA. S.D. Codified Laws § 45-6B-68.

INSPECTION [*Proposed* 43 CFR 3809.600]

Any refusal to allow inspection by the Board of Minerals and Environment is a violation of a mining permit. S.D. Codified Laws § 45-6B-72. The Board of Minerals and Environment must inspect a proposed mine site before issuing a mining permit. S.D. Codified Laws § 45-6B-20. Compliance inspections at any reasonable time are authorized by the South Dakota Water Pollution Control Act, S.D. Codified Laws § 34A-2-45, and the Air Pollution Control Act. S.D. Codified Laws § 34A-1-41.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

The MLRA authorizes the issuance of cease and desist orders for any violations of the MLRA, or permits or regulations thereunder. S.D. Codified Laws § 45-6B-49. Cease and desist orders also are authorized by the Mineral Exploration Act. S.D. Codified Laws § 45-6C-37. DENR can issue administrative orders to enforce the provisions of the Water Pollution Control Act, including emergency orders, S.D. Codified Laws § § 34A-2-48, 53, 60, 68, and the Air Pollution Control Act. S.D. Codified Laws § § 34A-1-44 through 51.

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

The Board of Minerals and Environment may modify, suspend or revoke a mining permit for violation of a permit provision. S.D. Codified Laws § 45-6B-51. Under the Mineral Exploration Act, the Board of Minerals and Environment also can suspend exploration activities for violations of an exploration permit. S.D. Codified Laws § 45-6C-39. DENR may revoke, suspend or modify permits issued under the Water Pollution Control Act, S.D. Codified Laws § § 34A-2-49 - 51, and the Air Pollution Control Act. S.D. Codified Laws § 34A-1-21.

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

The Board of Minerals and Environment may seek a temporary restraining order, a preliminary injunction, or a permanent injunction to prevent any further or continued violation of the MLRA. S.D. Codified Laws § 45-6B-52. The Mineral Exploration Act also authorizes temporary restraining orders, and preliminary and permanent injunctions. S.D. Codified Laws § 45-6C-40. DENR can seek to enjoin violations of the Water Pollution Control Act, S.D. Codified Laws § § 34A-2-65, 72, 73, and the Air Pollution Control Act. S.D. Codified Laws § 34A-1-52. A violator of any mining permit provision potentially is liable for damages to the environment. S.D. Codified Laws § 45-6B-70. Any person who violates the Mineral Exploration Act, S.D. Codified Laws § 45-6C-45, the South Dakota Water Pollution Control Act, S.D. codified Laws § 34A-2-75 or the South Dakota Air Pollution Control Act, S.D. Codified Laws § 34A-1-47, also is liable for damages to the environment. Other suits for damages are governed by common law. The state may sue to recover natural resource damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. 42 U.S.C. § 9607(f).

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

Any mining operation within one hundred feet of a lake or stream without a mining permit constitutes a misdemeanor crime. S.D. Codified Laws § 45-6B-71.1. Criminal violations of the South Dakota Water Pollution Control Act, S.D. Codified Laws § 34A-2-75, and the Air Pollution Control Act, S.D. Codified Laws § 34A-1-62, are misdemeanors punishable by jail terms or fines up to $10,000 per day of violation.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

Civil penalties of $100 to $1000 per day of violation can be assessed for violations of a mining permit, S.D. Codified Laws § 45-6B-70, and mining operations which occur without a mining permit. S.D. Codified Laws § 45-6B-71. The Mineral Exploration Act also authorizes civil penalties for violations, which include fines from $100 to $1000 per day, or for damages to the environment, or both. S.D. Codified Laws § 45-6C-45. DENR can seek civil penalties of up to $10,000 per day per violation or for damages to the environment of the state, or both, under the Water Pollution Control Act, S.D. Codified Laws §§ 34A-2-53, 75, and the Air Pollution Control Act. S.D. Codified Laws § 34A-1-39.

CITIZEN SUITS [No provision in proposed rule]

The MLRA does not authorize citizen suits. The South Dakota Compensation for Damages Act does authorize suits by surface owners for damages caused by mining activities. S.D. Codified Laws § § 45-5A-1-11. The South

Dakota Air Pollution Control Act preserves the right of any person to damages or other relief on account of injury to persons or property and to maintain any action or other appropriate proceedings. S.D., Codified Laws § 34A-1-54. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

UTAH

Mining operations, including reclamation activities, are regulated both by the Division of Oil, Gas and Mining (DOGM) within the Utah Department of Natural Resources (DNR) and the Department of Environmental Quality (DEQ). DOGM administers the Utah Mined Land Reclamation Act (MLRA).[6] Utah Code Ann. § § 40-8-1 - 23, Utah Admin. R647.[7] Before beginning surface mining operations, the MLRA requires that a notice of intention to conduct mining operations, including a reclamation plan, be approved by DOGM, Utah Code Ann. § 40-8-13, and the posting of surety with DOGM in an amount sufficient to reclaim the site. Utah Code Ann. § 40-8-14. The MLRA requires that during operations disturbed areas be reclaimed when no longer needed and areas which have been disturbed but are not routinely or currently used be kept in a safe, environmentally stable condition. Utah Admin. R647-4-107.6. Mining operations also must comply with the Utah Water Quality Act, Utah Code Ann. § § 19-5-101 - 120, Utah Admin. R317, and the Utah Air Conservation Act, Utah Code Ann. § § 19-2-101-127, Utah Admin. R307, administered by the DEQ.

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Mining operations must comply with the Utah Air Conservation Act, Utah Code Ann. §§ 19-2-101-127, Utah Admin. R307; including construction and operating permit requirements, administered by the Division of Air Quality (DAQ). Operators must minimize fugitive dust generated by (1) site preparation, mining activities, and reclamation activities, Utah Admin. R307-205-5, and (2) grading, excavating, depositing, or natural erosion, or other causes associated with a tailings operation, Utah Admin. R307-205-6. The Utah air pollution regulations specify acceptable fugitive dust control measures and may require a dust control plan to be submitted to DAQ. In addition should crushing, screening etc. be done at the mine site an Approval Order (permit) is required to be obtained from DAQ before the operation can proceed, Utah Admin. R307-401. Air quality requirements are part of Utah's State Implementation Plan (SIP) required by the federal Clean Air Act. 42 U.S.C. § 7410.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

With its notice of intention, an operator must file an impact assessment identifying projected impacts to surface and ground water systems. Utah Admin. R647-4-109.1. If natural channels have been affected by mining operations, then reclamation must be performed such that the channels will be left in a stable condition with respect to actual and reasonably expected water flow so as to avoid or minimize future damage to the hydrologic system. Utah Admin. R647-4-111.2. Detailed hydrologic information must also be submitted to DEQ with an application for a ground water discharge permit.

---

[6] The MLRA defines "reclamation" as:

> actions performed during or after mining operations to shape, stabilize, revegetate, or otherwise treat the land affected in order to achieve a safe, stable, ecological condition and use which will be consistent with local environmental conditions.

Utah Code Ann. § 40-8-4(14). The MLRA specifically states that it is not intended to "abrogate or interfere with any powers or duties" of DEQ. Utah Code Ann. § 40-8-5(3).

[7] The MLRA implementing regulations distinguish among exploration activities, Utah Admin. R647-2, small mining operations, Utah Admin. R647-3, and large scale mining operations. Utah Admin. R647-4.

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Point source discharges to surface waters from mining operations must obtain a Utah Pollutant Discharge Elimination System (UPDES) permit from the Division of Water Quality (DWQ) in DEQ. Utah Code Ann. § 19-5-107, Utah Admin. R317-8. The UPDES permit establishes limits on the amount of particular constituents which may be discharged. Utah Admin. R317-8-5. Mining operations must comply with the State's antidegradation policy and surface water quality standards which define the water quality goals of the State's water bodies by designating the use or uses to be made of the water and establishing criteria to protect those uses. Utah Admin. R317-2; 3.

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

Acid generation potential associated with surface runoff or discharges must be assessed with UPDES permits and Water Quality standards referenced above. Acid generation potential associated with ground water releases are assessed and regulated as part of the ground water permit and standards referenced below.

GROUND WATER [*Proposed* 43 CFR 3809.420(b)(2)(ii)]

Mining operations must comply with Utah's Ground Water Quality Protection Rules which seek to prohibit the reduction of ground water quality, to prevent ground water contamination, and to provide protection of existing levels of ground water quality. A ground water discharge permit from DWQ is required for any person or entity proposing to construct or operate a facility which could result in a release of contaminants to ground water. Utah Code Ann. § 19-5-107, Utah Admin. R317-6-6.2. Detailed hydrologic information must be submitted to DEQ with an application for a ground water discharge permit. Utah Admin. R317-6-6.3. A ground water discharge permit requires the use of best available treatment technology to minimize discharges and that such discharge not impair present and future beneficial uses of the ground water. Utah Admin. R317-6-6.4. Utah has adopted an anti-degradation policy for ground water which provides for the maintenance and protection of current and probable future beneficial uses of ground water, protection of higher quality waters at their existing water quality, and prevention of degradation of water quality that would be injurious to existing or potential beneficial use. Utah Admin. R317-2-3. Utah has adopted ground water quality standards for potential ground water contaminants based on the maximum contaminant levels (MCLs) established by the Safe Drinking Water Act. Utah Admin. R317-6-2. Any operator found to be in violation of permit conditions or otherwise in an out-of-compliance status, must promptly take corrective actions including preparation of a Contamination Investigation and implementation of a Corrective Action Plan monitored by DEQ. Utah Admin. R317-6-6.15.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Utah must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

If natural channels are to be affected by the mining operation, the operator must take appropriate actions to avoid or minimize the environmental damage, Utah Admin. R647-4-107.2, and reclamation must be performed such that the channels will be left in a stable condition with respect to actual and reasonably expected water flow so as to avoid or minimize future damage to the hydrologic system. Utah Admin. R647-4-111.2.

SOIL AND GROWTH MATERIALS [*Proposed* 43 CFR 3809.420(b)(4)]

The MLRA requires operators to remove suitable soil material and store such material in a stable condition where practical so as to be available for reclamation. Utah Admin. R647-4-107.5. After final grading, soil materials must be redistributed on a stable surface so as to minimize erosion, prevent undue compaction, and promote revegetation. Utah Admin. R647-4-111.12.

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

During revegetation, an operator must seed with adaptable perennial species that will grow on the site, provide basic soil and watershed protection, and support the post-mining land use. Utah Admin. R647-4-111.13. Revegetation is considered accomplished when the revegetation has achieved 70 percent of the pre-mining vegetative ground cover and the vegetation has survived three growing seasons following the last seeding, fertilization or irrigation, unless such practices are to continue as part of the post-mining land use. If the pre-mining vegetative ground cover is unknown, then the ground cover of adjacent undisturbed area that is representative of the pre-mining ground cover will be used as a standard. Utah Admin. R647-4-111.13.11.

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

With its notice of intention, an operator must file an impact assessment identifying projected impacts to state and federal threatened and endangered species or their critical habitat. Utah Admin. R647-4-109.2. The Utah Department of Natural Resources, Division of Fish and Wildlife reviews all mining and reclamation plans. Wildlife protection measures will be established on a site-specific basis before approval of a notice of intention. In addition, wildlife protection measures may be imposed in the ground water permit so as to prevent wildlife and public access to the facility.

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.4209(c)(1)]

In surface mining, and in open cuts for pads or roadways, highwalls must be reclaimed and stabilized by backfilling against them or by cutting the wall back to achieve a slope angle of 45 degrees or less. Utah Admin. R647-4-111.7. When on-site roads and pads will be used after the cessation of operations, the operator must turn over the property with adequate surface drainage structures and in a condition suitable for continued use. Utah Admin. R 647-4-111.8. Structures, rail lines, utility connections, equipment and debris must be buried or removed. Utah Admin. R647-4-111-11. After completion of operations, an operator must take actions to minimize hazards to the public safety and welfare including the disposal of trash, scrap metal and wood, buildings, extraneous debris, and other materials incident to mining. Utah Admin. R647-4-111.1.12.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

Drill holes must be plugged according to procedures established in the MLRA implementing regulations. DOGM may approve the plugging of drill holes in an alternative manner, if the operator can prove to the satisfaction of DOGM that another method will provide adequate protection to ground water and ensure long term stability of the land. Plugging must occur as soon as practical and drill holes cannot be left unplugged for more than 30 days without the approval of DOGM. Utah Code Ann. § 40-8-7(1)(c), Utah Admin. R647-4-108. After completion of operations, an operator must minimize hazards to the public safety and welfare including the permanent sealing of shafts and tunnels and the plugging of drill, core, or other exploratory holes in a manner consistent with the statutory and regulatory provisions of the MLRA. Utah Admin. R647-4-111.1.11, 12.

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

Operators must minimize fugitive dust generated by grading, excavating, depositing, or natural erosion, or other causes associated with a tailings operation. Utah Admin. R307-12-6. All deleterious or potentially deleterious material must be safely removed from the site or left in an isolated or neutralized condition such that adverse environmental effects are eliminated or controlled. Utah Admin. R647-4-107.4, 111.4. Waste piles, spoil piles, and fills must be regraded to a stable configuration and must be sloped to minimize safety hazards and erosion while providing for successful revegetation. Utah Admin. R647-4-111.6. At reclamation, water impoundment structures, including tailings ponds, must be self-draining and mechanically stable unless shown to have sound hydrologic design and to be beneficial to the post-mining land use. Utah Admin. R647-4-111.9.

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

Operators must minimize fugitive dust generated by (1) site preparation, mining activities, and reclamation activities, Utah Admin. R307-12-5, and (2) grading, excavating, depositing, or natural erosion, or other causes associated with a tailings operation. Utah Admin. R307-12-6. With its notice of intention, an operator must file an impact assessment identifying projected impacts on air quality, slope stability, erosion control, and public health and safety. Utah Admin. R647-4-109.4. Waste piles, spoil piles and fills must be regraded to a stable configuration and must be sloped to minimize safety hazards and erosion and provide for successful revegetation. Utah Admin. R647-4-111.6.

Mining operations and reclamation activities must be conducted so that sediment from disturbed areas is adequately controlled and the degree of erosion control must be appropriate for the site-specific and regional conditions of topography, soil, drainage, water quality, or other characteristics. Utah Admin. R647-4-107.3, 111.3.

An operator must leave the on-site area in a condition which is capable of supporting the post-mining land use. Utah Admin. R647-4-111.5. In surface mining, and in open cuts for pads or roadways, highwalls must be reclaimed and stabilized by backfilling against them or by cutting the wall back to achieve a slope angle of 45 degrees or less. Utah Admin. R647-4-111.7.

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

Prior to commencement of operations an operator must provide surety in amount determined by DOGM based on the magnitude, type, and costs of approved reclamation activities planned for the land affected and the nature, extent, and duration of operations. Utah Code Ann. § 40-8-14(1)(2). The form of surety can be any combination of contractual agreements, collateral, a bond or other form of insured guarantee, deposited securities, or cash. Utah Code Ann. § 40-8-14(3). Surety requirements are coordinated with other similar requirements made effective on the operator by landowners and other governmental agencies. Utah Code Ann. §40-18-14(4)

A surety is forfeited if the operator fails or refuses to carry out the necessary reclamation as outlined in the approved notice of intention. The forfeited surety is to be used only to reclaim the land for which it was posted. Utah Code Ann. § 40-8-14(7), Utah Admin. R647-4-114.

INSPECTION [*Proposed* 43 CFR 3809.600]

The MLRA authorizes inspections to ensure compliance with the terms of the MLRA, at all reasonable times, on affected land and all related properties included in a notice of intention. Utah Code Ann. § 40-8-17(2). DOGM must conduct an inspection of the property within 30 days of a notice of termination or extended suspension of surface mining operations. Utah Code Ann. § 40-8-21(3). DEQ possesses similar inspection authorities under the Utah Water Quality Act, Utah Code Ann. § 19-5-113, and the Utah Air Conservation Act. Utah Code Ann. § 19-2-108(6). State notification and approval from the Board of Oil, Gas and Mining is required for shutting down mining operations. Mining operations may have to be reclaimed after 5 years of continued suspension and must be reclaimed after 10 years.

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

The MLRA authorizes DOGM to hold an adjudicative proceeding "whenever it appears that any person, owner, or operator is violating any provision of [the MLRA], or any rule or order made under the authority" of the MLRA. Utah Code Ann. § 40-8-3(3)(a). If a violation is found, the MLRA authorizes abatement or compliance orders. Utah Code Ann. § 40-8-8(3)(c)(i). An emergency order may be issued if an immediate and significant danger of waste or other danger to the public health, safety, or welfare exists. Utah Admin. R647-5-106-18. Final orders are appealable to the Utah Supreme Court. Utah Code Ann. § 78-2-2(3)(e)(iv). DEQ also can issue administrative orders, including cessation of operation and penalties, under the Utah Water Quality Act, Utah Code Ann. § 19-5-104(1)(g), 19-5-111, 19-5-115, and the Utah Air Conservation Act. Utah Code Ann. § 19-2-110(1)(a).

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

DOGM may withdraw an approved notice of intention to conduct surface mining operations if (1) an operator substantially fails to perform reclamation or conduct mining operations so that the approved reclamation plan can be accomplished, (2) an operator fails to provide and maintain the required surety, or (3) mining operations are continuously shut down for a period in excess of five years, unless the extended period is accepted upon the operator's application. Utah Code Ann. § 40-8-16(2). If an approved notice of intention is withdrawn, all mining operations included within the notice must be suspended in accordance with procedures and a schedule approved by DOGM. Utah Code Ann. § 40-8-16(4). UPDES and ground water discharge permits also can be suspended by DEQ for violations of the statutory or regulatory provisions of the Utah Water Quality Act or permit conditions. Utah Code Ann. § 19-5-109, R317-6-6.7.

ENFORCEMENT – SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

If a violation of the MLRA is found in an administrative proceeding, a civil action can be brought to restrain the violator from continuing the violation. Utah Code Ann. § 40-8-8(3)(c)(ii). A court may issue temporary restraining orders, temporary injunctions, and permanent injunctions. Utah Code Ann. § 40-8-8(3)(d). DEQ also can seek injunctive relief under the Utah Water Quality Act, Utah Code Ann. § 19-5-115, and the Utah Air Conservation Act. Utah Code Ann. § 19-2-116. If an operator fails or refuses to conduct reclamation as outlined in the approved notice of intention, the Division's costs and expenses to reclaim together with costs of collection including attorney's fees, may be recovered in a civil action against the operator. Utah Admin. R647-4-114.1. The MLRA does not authorize actions for natural resources damages. However, the DEQ has filed complaints for natural resource damages in federal court under sections 107 and 113 of CERCLA, 42 U.S.C. §§9607, 9613.

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

The MLRA authorizes criminal misdemeanor penalties up to $10,000 for each violation for willful or knowing violations or omissions. Utah Code Ann. § 40-8-9(1)(a). In the case of an emergency order, Utah Admin, R647-5-106.18, the MLRA authorizes fines of $10,000 per day for willful failure to comply. Utah Code Ann. § 40-8-9(1)(b). Criminal penalties up to $50,000 per day of violation or six months imprisonment are authorized by the Utah Water Quality Act, Utah Code Ann. § 19-5-115, and the Utah Air Conservation Act authorizes criminal penalties of up to $50,000 per day of violation. Utah Code Ann. § 19-2-115.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

The MLRA authorizes civil penalties for failing to comply with the terms of any injunction or order issued by a court. Penalties for civil contempt, not to exceed $1,000 per day for each day of contempt, may be imposed in addition to fines imposed for violations of the MLRA. Utah Code Ann. § 40-8-8(3)(e). Civil penalties up to $10,000 per day of violation also are authorized by the Utah Water Quality Act, Utah Code Ann. § 19-5-115, and the Utah Air Conservation Act. Utah Code Ann. § 19-2-115.

CITIZEN SUITS [No provision in proposed rule]

Citizen suits are not authorized by the MLRA or Utah environmental laws. Citizens may request that the Water Quality Board issue a declaratory order by submitting a petition to the Board. Utah Code Ann. § 63-46b-21, Utah Admin. R317-1-8.4. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

WASHINGTON

In Washington, mining activities are regulated by the Department of Natural Resources (WADNR), which regulates surface mining operations and reclamation, and the Department of Ecology (WADOE) which regulates air, ground water and surface water quality, and solid and hazardous wastes. Wash. Rev. Code § 43.21A. The WADNR administers the Washington Surface Mined Land Reclamation Act (SMLRA). Wash Rev. Code tit. 78, ch. 44. The SMLRA requires all surface mining operations to obtain a reclamation permit from the WADNR. Wash. Rev. Code § 78.44.081. A reclamation permit cannot be issued without an approved reclamation plan, Wash. Rev. Code § 78.44.091, and the submission of a performance security conditioned upon the faithful performance of the operating and reclamation requirements of the SMLRA. Wash. Rev. Code § 78.44.087. Reclamation activities are to be conducted concurrent with surface mining and each segment of a mine must be reclaimed within two years of the completion of surface mining on that segment. Wash. Rev. Code § § 78.44.111, 131. In addition to the requirements imposed by the SMLRA, mining operations must comply with the Washington Water Pollution Control Law, Wash. Rev. Code tit. 90, ch. 48, Wash. Admin. Code tit. 173, ch. 216, 220, 225, 240, and the Washington Clean Air Act, Wash. Rev. Code tit. 70, ch. 94, Wash. Admin. Code tit. 173, ch. 400, 401, 460, 470, administered by the WADOE. The WADOE is the "lead state agency" for mining operations which include a metallic mineral processing plant. Wash. Admin. Code § 197-11-938(12).

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

All mining operations must comply with the Washington Clean Air Act, Wash. Rev. Code tit. 70, ch. 94, and implementing regulations, Wash. Admin. Code tit. 173, ch. 400-495, as administered by the WADOE. Mining operations must obtain new source construction approval from the WADOE, Wash. Rev. Code ch. 43.21A, 70.94, Wash. Admin. Code ch. 173-400, 173-460, and may need to comply with the prevention of significant deterioration air quality program. Wash. Rev. Code ch. 43.21A, 70.94, Wash. Admin. Code ch. 173-400-141. Surface mining operations must "take reasonable precautions to prevent fugitive dust from becoming airborne and shall maintain and operate the source to minimize emissions." Wash. Admin. Code § 173-400-040(8)(a). Air quality requirements are part of Washington's State Implementation Plan (SIP) required by the federal Clean Air Act. 42 U.S.C. § 7410.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

If surface mining occurs on flood plains or in river or stream channels, a reclamation plan must include a hydrogeologic evaluation which outlines measures that protect against, or mitigate, avulsion and erosion. Wash Rev. Code § 78.44.091(1)(i). A hydrologic analysis also is required for mining which impacts ground water. Wash. Rev. Code § 78.44.091(1)(j). If mining exposes natural materials that may create polluting conditions, the final ground surface must be graded so that surface water drains away from these materials. Wash. Rev. Code § 78.44.141(4)(g). Detailed hydrologic information is required for the issuance of permits by the WADOE pursuant to the Washington Water Pollution Control Law.

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Mining operations with point source discharges to surface waters must obtain a National Pollutant Discharge Elimination System (NPDES) permit from the WADOE. Wash. Rev. Code § 90.48.260, Wash. Admin. Code § 173-220. An applicant for an NPDES permit must submit information on water supply volumes, water use, waste water flow, characteristics and disposal methods, planned improvements, storm water treatment, plant operation, materials and chemicals used, production, and other information required by the WADOE. Surface water monitoring is required for all surface mining operations with an NPDES permit. Wash. Admin. Code § 173.220.210. Permitted discharges from a surface mining operation must meet surface water quality standards, Wash. Admin. Code § 173.204A.160(3), and comply with the State's antidegradation policy. Wash. Admin. Code § 173.201A.070. The SMLRA requires that reclamation activities establish self-sustaining vegetation and conditions of slope stability, surface water quality, and appearance before release of the performance bond. Wash. Rev. Code § 78.44.141(7).

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

All metals mining and milling operations are required to accurately identify the acid generating properties of the waste rock and to develop a strategy for encapsulating the potentially toxic material from the environment. The applicant must develop a plan for approval by WADNR and the WADOE that contains the identification of the acid generating properties, together with the encapsulation strategy and a reclamation plan in order to prevent the release of heavy metals and acid drainage to the environment. Wash. Rev. Code § 78.56.100. If surface mining exposes materials which may generate pollution, including acid-forming materials, an operator must grade the final ground surface so that surface water drains away from these materials and take other actions required by the WADNR. Wash. Rev. Code § 78.44.141(4)(g).

GROUND WATER [*Proposed* 43 CFR 3809.420(b)(2)(ii)]

All mining operations with the potential to degrade ground water must obtain a waste discharge permit from the WADOE. Wash. Rev. Code § 90.48.160. The waste water discharge permit will establish, on a site-specific basis, design requirements, performance standards, and monitoring criteria to protect ground water quality at a mine site. Wash. Admin. Code § § 173.216.110, 125. Permitted discharges from surface mining operations must preserve or protect beneficial uses for ground water, Wash. Admin. Code § 173.216.110(1)(d), and comply with the State's antidegradation policy. Wash. Admin. Code § 173.200.030.

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Washington must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

At reclamation, the SMLRA requires that drainages be "graded and contain adequate energy dissipation devices so that essentially natural conditions of water velocity, volume, and turbidity are reestablished within six months of reclamation." Wash. Rev. Code § 78.44.141(5). In addition, ditches and other artificial drainages must be constructed at reclamation "to control surface water, erosion, and siltation and to direct runoff to a safe outlet" and diversion ditches must be graded to limit erosion and siltation. Wash. Rev. Code § 78.44.141(5).

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

Reclamation plans must detail measures an operator will use to conserve topsoil. Wash. Rev. Code § 78.44.091(1)(k). The SMLRA minimum reclamation standards require mine operators to "carefully stockpile all topsoil on the site for use in reclamation" before surface mining begins. Miners may not sell topsoil or mix topsoil needed for reclamation with "sterile soils." Wash. Rev. Code § 78.44.141(1). Topsoil must be restored as needed to promote effective revegetation and stabilize slopes and mine floors. Wash. Rev. Code § 78.44.141(4)(f).

421

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

The basic objective of reclamation is "to reestablish on a continuing basis the vegetative cover, slope stability, water conditions, and safety conditions" consist with the post-mining use of the disturbed land. Wash. Rev. Code § 78.44.131. Revegetation is required "to stabilize slopes, generate new topsoil, reduce erosion and turbidity, mask rectilinear contours, and restore the scenic value" of the disturbed land. Wash. Rev. Code § 78.44.141(7). Revegetation must reestablish self-sustaining vegetation and conditions of slope stability, surface water quality, and appearance before release of a reclamation permit or performance bond. Wash. Rev. Code § 78.44.141(7)(f). Revegetation must begin during the first proper growing season after restoration of slopes and generally must include "diverse evergreen and deciduous trees, shrubs, grasses, and deep-rooted ground cover." Wash. Rev. Code § 78.44.141(7)(a), (c). The WADNR can require an operator to use "irrigation, fertilization and importation of clay or humus-bearing soils to establish effective vegetation." Wash. Rev. Code § 78.44.141(7)(e).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

The Washington Department of Wildlife reviews all applications for a reclamation permit and site-specific wildlife protection requirements will be included in a reclamation permit issued under SMLRA.

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

The SMLRA does not specify requirements for the removal of structures from a mine site but such requirements will be contained in an operating or reclamation permit.

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

The SMLRA does not specify requirements for sealing of exploration wells but such requirements will be contained in an operating or reclamation permit.

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

The SMLRA specifies reclamation setbacks for unconsolidated deposits and consolidated materials within mines permitted after June 30, 1993. Wash. Rev. Code § 78.44.121. A "reclamation setback" is defined as "those lands along the margins of surface mines wherein minerals and overburden shall be preserved in sufficient volumes to accomplish reclamation." Wash. Rev. Code § 78.44.031(12). Waste piles must be graded to comply with the SMLRA minimum reclamation standards for different types of surface mined slopes intended to stabilize the disturbed land and blend the reclaimed land with the surrounding area. Wash. Rev. Code § 78.44.141(4). Natural and other drainage channels must be kept free of "equipment, wastes, stockpiles, and overburden." Wash. Rev. Code § 78.44.141(5).

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

Surface mining operations must "take reasonable precautions to prevent fugitive dust from becoming airborne and shall maintain and operate the source to minimize emissions." Wash. Admin. Code § 173-400-040(8)(a). The basic objective of reclamation is "to reestablish on a continuing basis the vegetative cover, slope stability, water conditions, and safety conditions" consistent with the post-mining land use. Wash. Rev. Code § 78.44.131. Reclamation plans must contain information on slope stability. Wash. Rev. Code § 78.44.091(1)(k). The SMLRA specifies minimum reclamation standards for different types of surface mined slopes. Such standards are intended to stabilize the disturbed land and blend the reclaimed land with the surrounding area. Wash. Rev. Code § 78.44.141(4). Topsoil must be restored as needed to promote effective revegetation and stabilize slopes. Wash. Rev. Code § 78.44.141(7).

Reclamation plans must contain information on post-mining erosion and drainage control. Wash. Rev. Code § 78.44.091(1)(k). If surface mining exposes materials which may generate pollution, including acid-forming materials, an operator must grade the final ground surface so that surface water drains away from these materials and take other actions required by the WADNR. Wash. Rev. Code § 78.44.141(4)(g).

Reclamation plans must contain information on control of fill material, Wash. Rev. Code § 78.44.091(1)(k), and include maps showing contours and specifications for surface gradient restoration appropriate to the post-mining land use. Wash. Rev. Code § 78.44.091(2)(c). The floors of mines must "generally grade gently into post-mining drainages" to prevent erosion. Wash. Rev. Code § 78.44.141(4)(e). All grading must be done with non-noxious, noncombustible, and relatively incompactible solids. Wash. Rev. Code § 78.44.141(4)(h). Final reclaimed slopes must be left roughly graded, preserving equipment tracks, depressions, and small mounds "to trap clay-bearing soil and promote natural vegetation." Wash. Rev. Code § 78.44.141(4)(i).

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

WADNR will not issue a reclamation permit until a performance security has been deposited with the department. The performance security may be bank letters of credit, cash deposits, negotiable securities, assignment of bank accounts, assignments of interests in real property or a corporate surety bond. The amount of the performance security is determine by WADNR and is based on the estimated costs of completing reclamation according to the approved reclamation plan. Wash. Rev. Code § 78.44.087, Wash. Admin. Code §§ 332-18-120, 130, 140. WADNR may increase or decrease the amount of the performance security at any time to compensate for alterations in the conditions that affect the costs of reclamation. Wash. Rev., Code § 78.44.087(5). If an operator abandons a surface mine prior to completing reclamation, the WADNR may conduct reclamation with the costs of such reclamation to be deducted from the performance bond posted by the operator. Wash. Rev. Code § 78.44.240.

INSPECTION [*Proposed* 43 CFR 3809.600]

The WADNR may inspect a mine site at any time to determine compliance with the SMLRA, implementing regulations thereunder, and reclamation permits. Wash. Rev. Code § 78.44.161, Wash. Admin. Code § 332-18-050. The WADOE also may inspect mining operations at all reasonable times under the Water Pollution Control Law, Wash. Rev. Code § 90.48.090, and the Washington Clean Air Act. Wash. Admin. Code § 173-400-105(3).

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

The WADNR may issue an order to rectify deficiencies for surface mining in any manner not consistent with the SMLRA, implementing regulations, an approved reclamation plan, or a reclamation permit. Wash. Rev. Code § 78.44.190, Wash. Admin. Code § 332-18-05001. If this noncompliance creates an immediate danger to the public health, safety, welfare, or environment, the WADNR may issue an emergency order to suspend surface mining. Wash. Rev. Code § 78.44.200. The WADNR also may issue an order to suspend surface mining for failure to comply with an order to rectify deficiencies. Wash. Rev. Code § 78.44.210. The WADNR orders may include administrative penalties up to $10,000. Wash. Rev. Code § 78.44.250. The WADOE can issue administrative orders to enforce the Water Pollution Control Law, Wash. Rev. Code § 90.48.120(2), and the Washington Clean Air Act. Wash. Rev. Code § § 70.94.141(3), 331.

ENFORCEMENT – PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

The WADNR may order suspension of surface mining if operators fail to comply with an administrative order to rectify deficiencies. Wash. Rev. Code § 78.44.210. The WADNR may cancel a reclamation permit upon determining that a surface mine has been abandoned without completion of reclamation. Wash. Rev. Code § 78.44.230. In the event of such abandonment, the WADNR may conduct reclamation with costs paid from the posted performance bond. Wash. Rev. Code § 78.44.240. The WADOE can suspend or revoke permits issued pursuant to the authority of the Water Pollution Control Law and the Washington Clean Air Act.

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

The SMLRA authorizes legal actions to enjoin surface mining operations which continue in violation of an WADNR suspension order. Wash. Rev. Code § 78.44.210. The WADOE can seek injunctive relief for violations of the Water Pollution Control Law, Wash. Rev. code § 90.48.037, and the Washington Clean Air Act. Wash. Rev. Code § 70.94.425. The SMLRA does not authorize damage actions. The Water Pollution Control Act authorizes the assessment of natural resource damages for deaths or injuries to fish, animals, vegetation, or other resources resulting from violations of the Act, including significant degradation of water quality. Wash. Rev. Code § 90.48.142.

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

Operating without a valid reclamation permit is a gross misdemeanor. Wash. Rev. Code § 78.44.260. Criminal penalties authorized by the Water Pollution Control Law, Wash. Rev. code § 90.48.140, and the Washington Clean Air Act. Wash. Rev. Code § 70.94.430, include fines up to $10,000 and/or imprisonment up to one year.

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

The SMLRA authorizes civil penalties up to $10,000 for failing to comply with a WADNR order or the SMLRA. Wash. Rev. Code § 78.44.250, Wash. Admin. Code §§ 332-18-05003, 05004. Civil penalties up to $10,000 per day per violation also are authorized by the Water Pollution Control Law, Wash. Rev. Code § 90.48.144, and the Washington Clean Air Act. Wash. Rev. Code § 70.94.431.

CITIZEN SUITS [No provision in proposed rule]

Citizen suits are not authorized by the SMLRA, the Water Pollution Control Law, or the Washington Clean Air Act. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

WYOMING

Mining operations, including reclamation, are regulated pursuant to the Wyoming Environmental Quality Act (WEQA) by the Department of Environmental Quality (DEQ). Wyo. Stat. Tit. 35, ch. 11. WEQA is a comprehensive environmental statute that regulates hazardous waste, solid waste, water quality, air quality, and mining reclamation. Mining operations must obtain a mining permit from the DEQ, Land Quality Division (LQD).[8] Wyo. Stat. § 35-11-405. A mining permit cannot be issued without surface landowner consent and an approved mining and reclamation plan. Wyo. Stat. §§ 35-11-406(b)(xii), 35-11-405. All surface mining and reclamation activities must be conducted in conformity with a permittee's approved plan. Wyo. Stat. § 35-11-415(b)(ii). Performance bonds must be posted with LQD before commencing mining. Wyo. Stat. § 35-11-417. Reclamation must begin as soon as possible after mining begins and continue concurrently. LQD Rules ch. 111, § 2(k). Mining operations also must comply with the water quality control provisions of WEQA as administered by the DEQ Water

---

[8] WEQA defines "reclamation" as: the process of reclaiming an area of land affected by mining to use for grazing, agricultural, recreational, wildlife purposes or any other purpose of equal or greater value. The process may require contouring, terracing, grading, resoiling, revegetation, compaction and stabilization, settling ponds, water impoundments, diversion ditches, and other water treatment facilities in order to eliminate water diminution to the extent that existing water sources are adversely affected, pollution, soil and wind erosion, or flooding resulting from mining or any other activity to accomplish the reclamation of the land affected to a useful purpose. Wyo. Stat. § 35-11-103(e)(i).

Quality Division (WQD), Wyo. Stat. §§ 35-11-301 - 311, and the air quality control provisions of WEQA as administered by the DEQ Air Quality Division (AQD). Wyo. Stat. § § 35-11-201 - 212.

AIR QUALITY [*Proposed* 43 CFR 3809.420(b)(1)]

Mining operations must comply with the air quality control provisions of WEQA as administered by the Air Quality Division (AQD). Wyo. Stat. § 35-11-201 – 212, AQD Rules. AQD issues construction and operating permits for mining facilities which emit air pollutants, including fugitive dust. AQD Rules ch. I, § 21. The Wyoming air program includes ambient air quality standards for particulate matter, AQD Rules ch. I, § 3, and contains measures to control particulate emissions. AQD Rules ch. I, § 14. Air quality requirements are part of Wyoming's State Implementation Plan (SIP) required by the federal Clean Air Act. 42 U.S.C. § 7410.

WATER [*Proposed* 43 CFR 3809.420(b)(2)]

An applicant for a mining permit must provide information on surface and ground waters and immediate drainage areas. LQD Rules ch. 11, § 2(a)(i)(G), (H). Water flowing through or by mining operations must meet water quality standards. LQD Rules ch. 111, § 2(f)(vi), WQD Rules ch. I, VIII. Throughout mining and reclamation operations and for a five-year period after termination of the operation, an operator must prevent water pollution on affected land by "plantings and revegetation, the construction of drainage systems and treatment facilities…and the casing, sealing of boreholes, shafts, and wells" consistent with water quality standards. Wyo. Stat. § 35-11-415(b)(viii).

SURFACE WATER [*Proposed* 43 CFR 3809.420(b)(2)(i)]

Mining operations with point source discharges to surface water must obtain a National Pollutant Discharge Elimination System permit from the Water Quality Division (WQD) of DEQ. Wyo. Stat. § 35-11-302(a)(v), WQD Rules ch. XVIII. Throughout mining and reclamation operations and for a five-year period after termination of the operation, an operator must prevent water pollution on affected land by "plantings and revegetation, the construction of drainage systems and treatment facilities…and the casing, sealing of boreholes, shafts, and wells" consistent with water quality standards. Wyo. Stat. § 35-11-415(b)(viii).

GROUND WATER [*Proposed* 43 CFR 3809.420(b)(2)(ii)]

Mining operations must comply with State water quality standards that are prescribed to protect ground water "from pollution which may result from surface mining operations." WQD Rules ch. VIII, § 4(a)(iv). Water flowing through or by a mining operation must meet ground water quality standards. LQD Rules ch. 111, § 2(f)(vi), WQD Rules ch. VIII. Throughout mining and reclamation operations and for a five-year period after termination of the operation, an operator must prevent ground water pollution on affected land by "plantings and revegetation, the construction of drainage systems and treatment facilities…and the casing, sealing, of boreholes, shafts, and wells" consistent with water quality standards. Wyo. Stat. § 35-11-415(b)(viii).

ACID MINE DRAINAGE [*Proposed* 43 CFR 3809.420(b)(2)(i)(B) and (ii)(B)]

All topsoil removed from a permitted area must be protected from acid or toxic materials while it is stockpiled. Wyo. Stat. § 35-11-406(b)(viii), LQD-Non-Coal Rules Ch. III, Sect. 2(c). An operator may be required to have analyses made of spoil material in order to determine if it will be a source of water pollution through reaction with leaching by surface water. If it is determined that this condition may exist, the operator must describe proposed procedures for eliminating this condition in the reclamation plan. All overburden and spoil material that is determined to be toxic or acid-forming, unless such materials occur naturally on the land surface, must be properly disposed of during the mining operation. LQD-Non-Coal Rules Ch. III, Sect. 2(c)(iv). If an operator encounters unanticipated acid-forming materials during mining operations that are not addressed in the operator's mining or reclamation plan, the operator must notify the LQD Administrator no later than five days after making the discovery. LQD-Non-Coal Rules Ch. III, Sect. 2(1).

A reclamation plan must include a plan for ensuring that all acid-forming materials uncovered during or created by the mining process are promptly treated or disposed of during the mining process in a manner designated to prevent pollution of surface or subsurface water or threats to human or animal health and safety. Wyo. Stat. § 35-11-406(b)(ix).

WETLANDS AND RIPARIAN AREAS [*Proposed* 43 CFR 3809.420(b)(3)]

Any placement of soils or other fill materials in "waters of the United States," including dry washes, isolated waters and wetlands, must be permitted by the U.S. Corps of Engineers pursuant to Section 404 of the Clean Water Act. 33 U.S.C. § 1344. In reviewing the permit application, the Corps applies guidelines for disposal of fill materials promulgated by the Environmental Protection Agency. 40 C.F.R. pt. 230. The guidelines require that the Corps look at alternatives to the proposed fill activity before approving the permit application. Before the permit can be issued, Wyoming must issue a document certifying that the permit limitations will be consistent with state water quality standards. 33 U.S.C. § 1341.

Surface water must be diverted around a mining operation to "control water pollution; control unnecessary erosion; protect the on-going operation; [and] protect the water rights of down-stream users." LQD Rules ch. 111, § 2(e)(i). All overburden, spoil material, and refuse material must be located to avoid blocking drainages and flood plains in order to minimize loss and spread of the material by water erosion. LQD Rules ch. 111, § 2(c)(iv)(B).

Spoil, topsoil, or other unconsolidated material may not be pushed into, or placed below the flood level of, a stream except during the approved construction of the diversion of the stream. LQD Rules ch. 111, § 2(f)(i). The banks of a diverted stream must be protected by vegetation and, where necessary, rock, riprap or similar measures to minimize erosion and degradation of water quality. LQD Rules ch. 111, § 2(f)(iii), (iv). Mining on the flood plain of a stream is prohibited if such mining would cause the uncontrolled diversion of the stream during periods of high water. LQD Rules ch. 111, § 2(f)(v).

SOIL AND GROWTH MATERIAL [*Proposed* 43 CFR 3809.420(b)(4)]

All topsoil must be removed from all areas to be affected by surface mining operations. LQD Rules ch. 111, § 2(c)(i). Operators must protect "removed and segregated topsoil from wind and water erosion, and from acid or toxic materials, and preserve in a useable condition for sustaining vegetation when restored in reclamation" or do the same for suitable subsoil. Wyo. Stat. § 35-11-415(b)(iii), LQD Rules ch. 111, § 2(c)(i). If topsoil will not be used promptly, it must be stockpiled on stable areas to minimize wind and water erosion and unnecessary compaction, including the use of vegetative cover. LQD Rules ch. 111 § 2(c)(i)(B). If topsoil has been stockpiled for more than one year, LQD may require the operator to conduct nutrient analyses to determine if soil amendments are necessary. LQD Rules ch. 111, § 2(c)(i)(C). Subsoil must be handled like topsoil unless the subsoil is not suitable as a plant-growth medium or is not needed. LQD Rules ch. 111, §2(c)(ii). If insufficient topsoil or subsoil is available, an operator may use suitable overburden as a topsoil substitute. LQD Rules ch. 111, § 2(c)(iii). All topsoil must be removed from areas to be used for piling spoil material before beginning the stockpiling of such material. To reclaim tailings impoundments, operators must remove and store all topsoil present within the tailings basin and the topsoil must be replaced and revegetated at reclamation. LQD Rules ch. 111, § 2(h)(ii). Topsoil, or suitable substitute, must be distributed at an approximate uniform depth on the surface of all affected lands consistent with the post-mining land use. LQD Rules ch. 111, 2(c)(i)(E).

REVEGETATION [*Proposed* 43 CFR 3809.420(b)(5)]

Revegetation of all affected lands must be consistent with the reclamation plan and the future use of the land. LQD Rules ch. III, § 2(d)(i). Operators must plant native or superior self-regenerating vegetation on disturbed lands. Wyo. Stat. § 35-11-415(b)(vii). After grading, contouring, and the replacement of topsoil, initial revegetative efforts should facilitate the "retention of moisture" and the "control of erosion." LQD Rules ch. III, § 2(d)(iii). Seeding of affected lands must be conducted during the first normal period for favorable planting conditions after final preparation, and any rills or gullies that would preclude successful establishment of vegetation or post-mining land use must be removed or stabilized. LQD Rules ch. III, § 2(d)(iv). Seed types will depend on climatic and soil conditions prevailing in the permit area and the future use of the land, and species planted in permanent cover must be self-renewing. LQD Rules ch. III, § 2(d)(iv). Introduced, naturalized, or non-indigenous native plant species may be used if they support the approved post-mining land use. LQD Rules ch. III, § 2(d)(v).

LQD will deem revegetation to be complete when: (1) the vegetative cover of the affected land is shown to be capable of renewing itself under natural conditions prevailing at the site; (2) the vegetative cover and total ground cover are at least equal to the cover on the area before mining; (3) the productivity is at least equal to the productivity on the area before mining; (4) the species diversity and composition are suitable for the approved post-mining land use; (5) the revegetated area is capable of withstanding grazing pressure at least comparable to that which the land could have sustained prior to mining unless grazing is prohibited; and (6) the foregoing requirements are met for at least two consecutive years of the bonding period. LQD Rules ch. III, § 2(d)(vi). Operators must protect young vegetative growth from being destroyed by livestock with fences or other approved techniques for at least two years or until the vegetation is capable of renewing itself. LQD Rules ch. III, § 2(d)(viii). LQD can retain a portion of a performance bond for at least five years to assure proper revegetation of a reclaimed area. Wyo. Stat. § 35-11-423(a), LQD Rules ch. III, § 2(d)(vi).

FISH AND WILDLIFE [*Proposed* 43 CFR 3809.420(b)(6)]

Mine operators must restore wildlife habitat on affected land "in a manner commensurate with or superior to habitat conditions which existed before the land became affected." LQD Rules ch. III, § 2(a)(ii). An application for a mining permit must contain information on indigenous wildlife in the permit area. LQD Rules ch. II, §§ 2(a)(i)(E)(I). If critical or important habitat or migration route disruption is likely, the Game and Fish Department must determine the types and numbers of wildlife to be displaced. LQD Rules ch. II, § 2(a)(i)(E)(II). Violations of the WEQA, or any rule or regulation promulgated thereunder, that cause the death of fish, aquatic life or game or bird life makes an operator liable to pay the state for the reasonable value of the wildlife destroyed, in addition to other penalties provided by the WEQA. Wyo. Stat. § 35-11-903; Wyo. ADC, ch. II, § 2 (definitions).

ROADS AND STRUCTURES [*Proposed* 43 CFR 3809.420(c)(1)]

Roads and railroad spurs must include drainage control structures to control surface water runoff and minimize erosion, sedimentation, and flooding, and culverts must be installed at prominent drainways. LQD Rules ch. III, § 2(i)(iii), (iv). All buildings and structures must be removed, unless retention of the buildings and structures will benefit future use of the reclaimed land. (LQD Rules ch. III, § 2(j).

DRILL HOLES [*Proposed* 43 CFR 3809.420(c)(2)]

All drill holes must be capped, sealed or plugged pursuant to the standards contained in WEQA in order to prevent impacting water quality. Wyo. Stat. § 35-11-404, LQD Rules ch. VIII, § 2(a). Each drill site must be restored to its original condition, including any lands disturbed by the drilling. LQD Rules ch. VIII, § 2(b). Any person conducting exploratory drilling must post a performance bond with LQD that cannot be released until LQD has inspected and evaluated the hole completion and surface restoration. LQD Rules ch. VIII, § § 3, 4(a). Performance bonds will be forfeited if a driller fails to adequately fill a drill hole and restore affected lands. LQD Rules ch. VIII, § 4(b). All shafts and adits to underground mine workings must be properly sealed at closure. LQD Rules ch. IV, §

2(a)(ii). Failure to comply with these requirements may impose criminal liability. Wyo. Stat. § 35-11-404(k). In addition, throughout mining and reclamation operations and for a five-year period after termination of the operation, an operator must prevent surface and ground water pollution on affected land by "the casing, sealing, of boreholes, shafts, and wells." Wyo. Stat. § 35-11-415(b)(viii).

ACID-FORMING, TOXIC, OR OTHER DELETERIOUS MATERIALS. [*Proposed* 43 CFR 3809.420(c)(3)]

All overburden and spoil material that is determined to be toxic or acid-forming, unless such materials occur naturally on the land surface, must be properly disposed of during the mining operation. LQD-Non-Coal Rules Ch. III, Sect. 2(c)(iv).

WASTE ROCK, TAILINGS AND LEACH PADS [*Proposed* 43 CFR 3809.420(c)(5)]

Operators must "cover, bury, impound, contain, or otherwise dispose" of toxic acid-forming material or any material hazardous to health or safety or which threatens surface or ground water. Wyo. Stat. § 35-11-415(b)(iv). All overburden, spoil material and refuse material must be segregated from the topsoil and subsoil; stockpiled in a manner to facilitate the earliest reclamation consistent with the approved reclamation plan; and located so as to avoid blocking drainages and flood plains, thereby minimizing loss and spread of the material due to water erosion. LQD Rules ch. 111, § 2(c)(iv)(A), (B). Permanent overburden, spoil, or refuse piles must be graded and contoured so that the piles are stabilized against wind and water erosion, a permanent drainage system must be established, and the piles must be revegetated. LQD Rules ch. 111, § 2(c)(iv)(B)(11). All topsoil must be removed from areas to be used for piling spoil material before beginning the stockpiling of such material. LQD Rules ch. 111, § 2(c)(iv)(C). The operator may be required to analyze spoil material to determine if it will be the source of water pollution, and, if so, the operator must take efforts to eliminate this condition. LQD Rules ch. 111, § 2(c)(iv)(D). All overburden and spoil material that is determined to be toxic or acid-forming or that will prevent adequate reestablishment of vegetation must be properly disposed of during the mining operation. LQD Rules ch. 111, § 2(c)(iv)(E). To reclaim tailings impoundments, operators must remove and store all topsoil present within the tailings basin, and the topsoil must be replaced and revegetated at reclamation. LQD Rules ch. 111, § 2(h)(ii). All overburden and spoil material that is determined to be toxic or acid-forming, unless such materials occur naturally on the land surface, must be properly disposed of during the mining operation. LQD-Non-Coal Rules Ch. III, Sect. 2(c)(iv).

STABILITY, GRADING AND EROSION CONTROL [*Proposed* 43 CFR 3809.420(c)(6)]

Reclamation may require compaction and stabilization of affected lands to eliminate soil or wind erosion, including fugitive dust, which results from mining operations. Wyo. Stat. § 35-11-103(e)(i). Slopes of all areas must be designed so that they will be stabilized against wind and water erosion. LQD Rules ch. 111, § 2(c)(iv)(B)(11). Stabilization means "to control movement of spoil, spoil piles, or areas of disturbed earth by modifying the geometry of the mass, adding control structures, or otherwise modifying physical or chemical properties." LQD Rules ch. l, § 2(bg).

Permanent overburden, spoil, or refuse piles must be graded and contoured so that the piles are stabilized against wind and water erosion, a permanent drainage system must be established, and the piles must be revegetated. LQD Rules ch. 111, § 2(c)(iv)(B)(11). Any rills or gullies that would preclude successful establishment of vegetation or achievement of post-mining land use must be removed or stabilized. LQD Rules ch. 111, § 2(d)(iv). Permanent diversion structures must be erosionally stable. LQD Rules ch. 111, 2(e)(iv).

At reclamation, disturbed land must be contoured in a manner consistent with future land use, including backfilling, grading, and replacing topsoil. Wyo. Stat. § 35-11-415(b)(v), (vi), LQD Rules ch. 111, § 2(b). Pits that are not approved for permanent water impoundments must be "backfilled, graded, compacted, and contoured to the extent necessary to return the land to the use specified," and provision for such must be included in the approved reclamation plan. LQD Rules ch. 111, § 2(b)(ii), (iii). Contouring means "grading or backfilling and grading the land affected and reclaiming it to the proposed future use with adequate provisions for drainage." Wyo. Stat. § 35-11-103(e)(iii).

FINANCIAL GUARANTEE [*Proposed* 43 CFR 3809.500 – 599]

A mining operator must post a bond to assure faithful performance of his duties under the WEQA. Wyo. Stat. § 35-11-417(a). The initial bond must be in an amount equal to the estimated cost of reclaiming the affected land disturbed and restoring any groundwater disturbed by situ mining during the first year of operation. Wyo. Stat. § 35-11-417(c)(i). Renewal bonds must be in an amount equal to the estimated cost of reclaiming the land to be disturbed during that renewal period, and the estimated cost of completing reclamation on unreleased lands and groundwater disturbed during prior periods. Wyo. Stat. § 35-11-417(c)(ii). Upon completion of the reclamation plan, 25 percent of the bond, or not less than $10,000, will be retained by the DEQ for a period of at least five years to assure proper revegetation and restoration of groundwater. Wyo. Stat. § 35-11-417(e). An operator may deposit cash, federally insured certificates of deposit, or government securities in lieu of a bond. Wyo. Stat. § 35-11-418. A performance bond can be forfeited for violation of WEQA. Wyo. Stat. § 35-11-421. If the amount of a forfeited performance bond is inadequate to cover the costs of final reclamation, legal action can be brought to recover the remaining costs. Wyo. Stat. § 35-11-422.

INSPECTION [*Proposed* 43 CFR 3809.600]

LQD must inspect a mining site at least once a year, in conjunction with the permittee's annual report, for purposes of establishing the amount of the performance bond for the next year. Wyo. Stat. § 35-11-411. A performance bond cannot be released until inspection of a reclaimed site. Wyo. Stat. § 35-11-423(c).

ENFORCEMENT ORDERS [*Proposed* 43 CFR 3809.601]

WEQA authorizes cease and desist orders for any violations of the statutory or regulatory provisions of WEQA or permits issued thereunder, including a mining permit. Wyo. Stat. § 35-11-701(c)(i). After an administrative hearing, the WEQA authorizes issuance of orders for the prevention, abatement, or control of violations of the WEQA, or rules, regulations, or permits issued pursuant to the WEQA. Wyo. Stat. § 35-11-701(c)(iii). The Director of the DEQ may issue emergency orders to discontinue actions if the director finds that a condition of air, water, or land pollution exists and that it creates an emergency requiring immediate action to protect human or animal health or safety. Wyo. Stat. § 35-11-115(a).

ENFORCEMENT -- PERMIT SUSPENSION OR REVOCATION [*Proposed* 43 CFR 3809.602]

The Director of DEQ is authorized to suspend and revoke mining permits. Wyo. Stat. § 35-11-109(a)(xiii), § 35-11-409(a), § 35-11-412.

ENFORCEMENT -- SUITS FOR INJUNCTIONS AND/OR DAMAGES [*Proposed* 43 CFR 3809.604]

A court can issue an injunction to enjoin continuing violations of WEQA statutory or regulatory provisions, permits, or orders. Wyo. Stat. § 35-11-901(a). If the Director of the DEQ has evidence that any air, water, or land pollution source presents an immediate and substantial danger to human or animal health and safety, he may institute a civil action for immediate injunctive relief to halt any activity causing the danger. Wyo. Stat. § 35-11-115(b). A court can assess damages for violations of WEQA statutory or regulatory provisions, permits, or orders. Wyo. Stat. § 35-11-90(b). In addition, natural resource damages are assessed for violations of the WEQA which cause the "death of fish, aquatic life or game or bird life." Wyo. Stat. § 35-11-903. Other suits for damages are governed by common law. The state may sue to recover natural resource damages under section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act. 42 U.S.C. § 9607(f).

CRIMINAL PENALTIES [*Proposed* 43 CFR 3809.700]

WEQA authorizes criminal penalties, including fines up to $25,000 per day of violation and up to a year in prison, or both, for willful and knowing violations of WEQA statutory or regulatory provisions, permits, or orders. For multiple violations, penalties may be assessed up to the maximum amount for each day of each separate violation. Subsequent convictions can incur up to $50,000 per day of violation, imprisonment for up to two years, or both. Wyo. Stat. § 35-11-901(j).

CIVIL PENALTIES [*Proposed* 43 CFR 3809.702]

Civil penalties of up to $10,000 per violation per day can be assessed for violations of WEQA statutory or regulatory provisions, permits, or orders. Wyo. Stat. § 35-11-901(a). Any person who causes the death of fish, aquatic life or game or bird life by violations to the WEQA statutory or regulatory provisions, in addition to other penalties provided by the act, is liable to pay to the state an additional sum for the reasonable value of the wildlife destroyed. Wyo. Stat. § 35-11-903.

CITIZEN SUITS [No provision in proposed rule]

WEQA does not authorize citizen suits for violations of its water, air or surface mining provisions. The federal Clean Water Act authorizes citizen suits against persons who violate provisions of the Clean Water Act or state administrative orders that implement that Act.

430

APPENDIX E
CHANGES IN MINERAL ACTIVITY

FUTURE MINERAL ACTIVITY

To help assess the reasonably foreseeable environmental impacts of the proposal and alternatives, the EIS team developed several assumptions on future mineral exploration and development under existing regulations, management practices, and policies (the No Action Alternative). These assumptions are fairly general, given the diversity of mining on public lands, variety of mining and exploration methods, commodities extracted, geographic scope, and inherent uncertainty of the commodities markets. These assumptions concerning the future under the No Action Alternative are made only for the purpose of EIS analysis, and to set the basis for comparison of the alternatives.

- Long-term commodity prices will remain relatively stable. Short-term price movement and volatility will continue for individual commodities. For example, the short-term prices for some metals will continue to be under pressure. But for the foreseeable future no obvious factors would suggest a trend of long-term increases or decreases in commodity prices, individually or collectively.

- Domestic exploration will remain relatively constant. Short-term increases and decreases in exploration, such as a recent decline, will continue in response to market and regulatory conditions. Exploration on public lands over the long term will also remain relatively constant.

- Long-term domestic production of minerals and the proportion coming from public lands will remain relatively stable. Short-term and commodity-specific changes will continue. Extended periods of lower or higher prices will affect short-term development and production decisions. Domestic gold production will likely remain flat or will slightly decline. Copper production will decline in the immediate future in response to market conditions but will likely recover in the longer term. Industrial mineral production will continue to increase, reflecting continued long-term growth in the domestic, regional, and most local economies.

- Existing mines will expand to take advantage of new technology and processing techniques, and will increasingly extract refractory-grade ores. These advances will be reflected in reduced capital and operating costs.

- The current geographic distribution of mineral activity will not change. For example, large open pit gold mining will remain concentrated in Nevada. Placer mining production will be concentrated in Alaska. Arizona will dominate large open pit copper mining. The mining of industrial minerals will remain more evenly distributed across the study area.

- Lands under federal ownership will remain the same for the foreseeable future.

431

- Public lands open to mineral entry under the mining laws will continue to decrease in the long term as sensitive lands are set aside for environmental protection. The rate of this decline will vary in the short term, depending on the political and social climate. Although land availability is a critical factor in future mineral activity, mineral production on public lands has continued to increase since 1980 in spite of lands being withdrawn from mineral entry. This could also be due to the lag time between exploration and production, i.e. the high exploration rate in the 80s is responsible for the high production in the late 90s. The results of decreased land availability in the 90s and 2000s won't be felt until ~2005.

- Although a logical negative relationship exists between land withdrawals and future production, other factors such as emerging technology, global and domestic demands, and the large areas of public lands open to exploration and development have resulted in increasing production from public lands.

- Federal, state, and local environmental laws, regulations, policies, and restrictions will continue to become more protective over time. These limits to mineral exploration and development will affect federal, state, and private lands. In the face of increasing environmental restrictions, mineral production from public lands has increased since 1980. As with the discussion above of the effect of land withdrawals on future production, other factors (technology and demand) are likely to counterbalance the negative effect of increasing environmental restrictions on mineral activity.

- Overall, mineral activity on public lands will remain steady despite large drops in the past few years in the number of Notices and Plans of Operations reviewed by BLM. No overriding factors would suggest that a trend of increased or decreased activity has been established for either the short or long term. Activity will remain at current levels for the foreseeable future, including BLM's estimated review each year of 600 Notices and 150 Plans of Operations. The number of Notices and Plans of Operations filed and acres of disturbance expected under current management are discussed in the Mineral Resource Development section of Chapter 3.

CHANGES IN MINERAL ACTIVITY

Expected changes in mineral activity levels were estimated for each alternative. As with the assumptions for future mineral activity discussed above, it is neither practical nor even possible to develop complete information on future changes in mineral activity resulting from implementing the regulatory alternatives. The approach used to document the reasonably foreseeable significant effects conforms to the requirements at 40 CFR Part 1502.22 when dealing with situations where information is incomplete or unavailable. But this approach has substantial limitations. As such, the estimates are presented as reasonably foreseeable assumptions on future activity. The estimated changes in mineral activity are intended to help evaluate the environmental consequences of the proposed regulations and alternatives, and give the public and decision makers information on the potential direction and size of change. The assumptions are estimates of the expected changes in mineral activity and should not be considered accurate or precise estimates of change.

Appendix E: Changes in Mineral Activity

The changes in mineral activity were estimated based on interpretations by members of the EIS team using several information sources. These sources include impact matrixes and mine cost models (discussed below) developed for this EIS, in addition to team member expertise, knowledge, and experiences. The EIS team members directly involved in making the estimates of change were Wendy Favinger, (Economist, BLM Montana State Office), Scott Haight (Mineral Specialist, BLM Lewistown Field Office, Montana), Paul McNutt (Economist, BLM Nevada State Office) and Dan Netcher (Geologist, BLM Ely Field Office, Nevada). The processes for interpreting these information sources were not standardized. Each team member independently interpreted the impact matrices and mine cost model results. We then compiled and discussed the estimates of change. This process involved several rounds of making, compiling, and discussing estimates of change. Through this iterative process, we reached a group estimate for each of the 10 types and sizes of mineral activity. Because of the uncertainties in forecasting and the many comments received on the estimates presented in the draft EIS, we opted to present the estimates of changes in mineral activity as ranges in the final EIS.

The process used by the EIS team to estimate changes in mineral activity and also to construct the impact matrixes is generally referred to as the Delphi Method. The Delphi Method is a decision making or forecasting process for addressing highly complex or ambiguous issues where factual data is absent. The process was originally developed by the Rand Corporation, a U.S. intelligence "think tank." The process is widely accepted and used to forecast events and outcomes.

Due to the limitations in data for mineral properties potentially affected by the proposed regulations and alternatives and the many potential affected properties, we deemed infeasible the applying of other analytic techniques to estimate changes in mineral activity. We selected the Delphi Method because of its past use in forecasting futures. We believed that this methodology was the most suitable approach for forecasting changes in mineral activity as a result of the implementing programmatic requirements.

Changes in mineral activity can be manifested in several ways, including changes in exploration and mining, acres disturbed, mine life, cutoff grade, and annual production. The response to changes in the regulations will be unique for each operation. As such, the following discussion is limited to change in overall activity without attempting to define how that change may be manifested.

Alternative 1–The No Action Alternative assumes that the current management and regulations continue unchanged. Thus the regulations are not expected to alter existing or future levels of mining. This does not necessarily mean that the level of future mining would not change. Many factors will affect the level of activity in both the short and long term. Commodity price, availability of lands for exploration and development, and environmental restrictions are key considerations that will affect future mineral activity. But no obvious or overriding factors would suggest that a trend of increases or decreases in activity for either the short or long term has been established. For this EIS, the overall future of mining under the Mining Law is assumed to remain relatively steady under existing regulations, management practices, and policies. It is from this baseline that the other alternatives are compared.

433

Alternative 2–The State Management Alternative would limit BLM's role in regulating activity under the Mining Law on public lands to that of a land owner. In most states this regulatory approach is expected to have the potential to reduce the regulatory burden to mining operations, thus potentially increasing the level of mineral activity. Overall mineral activity on public lands is assumed to remain unchanged or increase by as much as 5% under Alternative 2. The greatest potential for increases in activity are expected in larger mining operations, specifically those now requiring EISs with extensive baseline studies. This regulatory burden would not decline and mineral activity increase uniformly in all states. For example, California and Montana have state versions of the National Environmental Policy Act. Proposed operations in those two states would not avoid the costs and time delays of preparing EISs. For a better understanding of the state regulatory programs in place, see Appendix D.

Alternative 3–For the proposed regulations, the estimate of change in mineral activity on public lands under the Mining Law will depend on the size and type of mineral operation (see Table E-1). The level of casual use is expected to remain relatively unaffected with the exception of some suction dredging. Exploration and mining now conducted under Notices and Plans of Operations are expected to decline by 5% to 30% from the baseline.

The financial guarantee and Notice/Plan threshold provisions in the proposed regulations would directly affect small mining operations that are now being conducted under Notices. Current Notice-level operations that would be required to submit Plans of Operations and follow the other provisions under this alternative would see direct costs increase by as much as 37%. Except for small open pit mines, Notice-level operations would decline in mineral activity by 10 to 20%. The estimated range of change in activity for open pit mines would be a 10 to 30% reduction.

For larger scale operations–those now required to submit Plans of Operations–the change in the definition of unnecessary or undue degradation in the proposed alternative to include "conditions, activities, or practices that result in substantial irreparable harm to significant scientific, cultural, or environmental resource values of the public lands that cannot be effectively mitigated" presents the greatest potential impact on the anticipated level of mineral activity on public lands. For large open pit mines the backfilling provision could also greatly increase operating costs and reduce activity. But because of the discretion given BLM in the proposed backfilling provision, changes in costs and activity levels are extremely difficult to estimate and would likely vary by mining project. For large open pit mines under the proposed regulations, the reduction in activity is estimated at 10 to 30%. This wide range in the estimated decline of open pit mining reflects the uncertainty inherent in how these two provisions in the proposal will be interpreted, implemented, and enforced.

Alternative 4–The alternative that is likely to most reduce overall mineral activity would also give the greatest level of environmental protection. Depending on the type of activity, Alternative 4 would reduce the individual mineral activity by 10% to 75%. Many of the provisions that would reduce activity levels, including the following:

- Eliminating the Notice provision.
- Requiring claim validity before mining.
- Mandatory penalties and enforcement.
- Automatic stays of all appealed decisions.
- Mandatory backfilling.
- Establishing specific unsuitability criteria and applying the new regulations to existing operations.

Alternative 5–The NRC Recommendations Alternative incorporates the numbered recommendations for regulation changes from the (NCR Report). The expected reduction in mineral activity under this alternative would mainly occur in small mining operations that are now Notice-level operations. The financial guarantee and Notice/Plan threshold provisions contained in this alternative will have a direct impact on small mining operations. For small placer, open pit, underground and industrial mines we estimate there will be a 5 to 10% reduction in mineral activity. For casual use, exploration and most large mining operations, mineral activity is assumed to remain unchanged or decrease up to 5% under Alternative 5.

Table E-1 gives a breakdown of the expected changes by type and size of mineral operation for each alternative except Alternative 1.

IMPACT MATRIXES

One analytic tool used to assess the potential effects of the are the impact matrixes that consider how each regulation provision would affect a particular mineral activity (See Tables E-2, thru E-5). The rating, weights and scores in these matrixes were developed using a qualitative process based on the expertise of EIS team members. The process is not intended to generate precise measurements of effect, but rather to show the direction and size of those potential changes and which regulatory provisions are likely to have the most effect.

The regulatory provisions were grouped into 28 regulation components (e.g. Notice-Plan Threshold, Appeals Process and Stay Provisions, Performance Standards: Pit Backfilling), and 10 mine types and sizes (e.g. small placer, large open pit). Specialists on the EIS team independently rated the effect each regulation component would have on the different types and sizes of mines, using the following scale: negligible or none = N, low positive or negative = L±, medium positive or negative = M±, and high positive or negative = H±. The team assigned a number values to each of the rating, N = 0, L =1, M = 3 and H =5. Each regulatory provision was weighted based on their relative importance to one another. The weighed values ranged between 1 to 5. The team then compiled and discussed the ratings. At several other rounds ratings were collected, compiled, and discussed. Through this iterative process a group rating was reached for each of the 28 regulation components. Tables E-2, E-3, E-4 and E-5 show the ratings for each of the provisions.

435

Table E-1. Percent Change in Mineral Activity

Alternative	Casual Use/ Suction Dredging	Exploration		Placer		Open Pit		Underground		Industrial Mine
		Small	Large	Small	Large	Small	Large	Small	Large	
2	0	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5
3	-5 to -10	-10 to -20	-10 to -20	-10 to -20	-5 to -15	-10 to -30	-10 to -30	-10 to -20	-5 to -15	-5 to -15
4	-40 to -50	-20 to -30	-20 to -30	-20 to -30	-15 to -25	-50 to -75	-50 to -75	-15 to -25	-10 to -20	-10 to -20
5	0	0 to -5	0 to -5	-5 to -10	0 to -5	-5 to -10	0 to -5	-5 to -10	0 to -5	-5 to -10

Note: The presented ranges reflect the uncertainties in estimating the impacts to mineral activity. Where there are greater uncertainty in assessing the potential impacts of an alternative on a particular size and/or type of mineral activity a larger range is presented.

Table E-2. Alternative 2 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Definition of Federal Lands Where Regulations Apply	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice vs. Plan of Operations Threshold	5	N	0	L+	5	L+	5	L+	5	L+	5	L+	5	L+	5	L+	5	L+	5	L+	5
Definition of Casual Use	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice and Plan of Operations Content and Processing Requirements	3	N	0	L+	3	M+	0	L+	3	M+	0	L+	3	M+	0	L+	3	L+	3	L+	3
State and Federal (BLM) Coordination	3	N	0	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3
Claim Validity/Valid Existing Rights and Economic Viability	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Common Variety Materials Determinations	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Inspection and Monitoring Requirements	2	N	0	L+	2	L+	2	L+	2	L+	2	L+	2	L+	2	L+	2	L+	2	L+	2
Penalties and Enforcement Procedures	3	N	0	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3
Financial Guarantee (Bonding) Requirements	4	N	0	N	0	L+	4	N	0	L+	4	N	0	L+	4	N	0	L+	4	L+	4
Modifications	2	N	0	N	0	N	0	L+	<2	N	0	L+	<2	N	0	L+	<2	N	0	L+	<2
Temporary or Permanent Closure	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Appeals Process and Stay Provisions	3	N	0	N	0	L+	3	N	0	L+	3	N	0	L+	3	N	0	L+	3	L+	3
Project Area Definition	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0

Table 5-2. Alternative 2 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Applying Regulation Changes to Existing Operations	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Administrative Impact Subtotal			0		10		20		10		20		10		20		10		20		20
General Performance Std/U or U Definition	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Land Use Plans	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Stability, grading, and erosion control	3	N	0	L+	3	N	0	L+	3	N	0	L+	3	N	0	N	0	N	0	L+	3
Pit Reclamation	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Roads and Structures	3	N	0	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3
Leaching and Processing Operations	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Surface and Ground Water Protection	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Acid-Forming and Other Deleterious Material	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Topsoil or Growth Medium Handling	3	N	0	L+	3	N	0	L+	3	N	0	L+	3	N	0	L+	3	N	0	L+	3
Revegetation	3	N	0	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3

Table E-2. Alternative 2 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Fish and Wildlife Protection/Restoration	3	N	0	L+	3	L+	3	M+	9	M+	9	M+	9	M+	9	L+	3	M+	9	M+	9
Wetlands and Riparian Protection/Restoration	3	N	0	L+	3	L+	3	M+	9	M+	9	L+	3	M+	9	L+	3	M+	9	M+	9
Cultural, Paleo, Cave Resource Protection	3	N	0	M+	9	H+	15	M+	9	H+	15	M+	9	H+	15	M+	9	H+	15	H+	15
Performance Standards Impact Subtotal			0		27		27		30		39		33		39		24		39		45
Administrative and Performance Standard Impact Total			0		43		66		57		68		61		68		42		62		70

Table E-3. Alternative 3 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Definition of Federal Lands Where Regulations Apply	2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2
Notice vs. Plan of Operations Threshold	5	L-	-5	M-	-15	N	0	H-	-25	N	0	H-	-25	N	0	H-	-25	N	0	M-	-15
Definition of Casual Use	1	M-	-3	L-	-1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice and Plan of Operations Content and Processing Requirements	3	L-	-3	L-	-3	L-	-3	M-	-9	M-	-9	M-	-9	L-	-3	M-	-9	L-	-3	M-	-9
State and Federal (BLM) Coordination	3	L+	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Claim Validity/Valid Existing Rights and Economic Viability	4	N	0	M-	-12	M-	-12	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4
Common Variety Materials Determinations	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Inspection and Monitoring Requirements	2	N	0	N	0	N	0	L-	-2	L-	-2	L-	-2	N	0	L-	-2	N	0	L-	-2
Penalties and Enforcement Procedures	3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Financial Guarantee (bonding) Requirements	4	N	0	M-	-12	L-	-4	H-	-20	L-	-4	H-	-20	M-	-12	H-	-20	L-	-4	M-	-12
Modifications	2	N	0	L-	-2	L-	-2	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2

Table E-3. Alternative 3 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	WL	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Temporary or Permanent Closure	2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2
Appeals Process and Stay Provisions	3	N	0	L+	+3	L+	+3	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Project Area Definition	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Applying Regulation Changes to Existing Operations	4	N	0	N	0	N	0	N	0	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4
Administrative Impact Subtotal			-13		-40		-23		-40		-34		-73		-34		-73		-38		-45
General Performance Std/U or U Definition	5	N	0	L-	-5	M-	-15	H-	-25	H-	-25	H-	-25	H-	-25	M-	-15	H-	-25	H-	-25
Land Use Plans	3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	M-	-6	L-	-3	L-	-3	L-	-3
Stability, Grading, and Erosion Control	3	L-	-3	N	0	N	0	N	0	N	0	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Pit Reclamation	5	N	0	N	0	N	0	L-	-5	L-	-5	M-	-15	M-	-15	N	0	N	0	L-	-6
Roads and Structures	3	N	0	N	0	N	0	N	3	N	0	N	0	N	0	N	0	N	0	N	0
Leaching and Processing Operations	4	N	0	N	0	N	0	N	0	N	0	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4
Surface and Ground Water Protection	5	N	0	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5

Table E-3. Alternative 3 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	**Impact**	**Score**	**Impact**	**Score**	**Impact**	**Score**	**Impact**	**Score**	**Impact**	**Score**	**Impact**	**Score**	**Impact**	**Score**	**Impact**	**Score**	**Impact**	**Score**	**Impact**	**Score**
Acid-Forming and Other Deleterious Material	4	N	0	N	0	N	0	N	0	N	0	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4
Topsoil or Growth Medium Handling	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Revegetation	3	N	0	M-	-6	L-	-3	M-	-6	N	0	N	0	N	0	N	0	N	0	N	0
Fish and Wildlife Protection/Restoration	3	N	0	L-	-3	N	0	M-	-6	L-	-3	L-	-3	L-	-3	L-	-3	N	0	L-	-3
Wetlands and Riparian Protection/Restoration	3	L-	-3	N	0	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	N	0	L-	-3
Cultural, Paleo, Cave Resource Protection	3	N	0	L-	-3	N	0	N	0	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Performance Standards Impact Subtotal			-6		-28		-20		-60		-47		-48		-74		-43		-47		-48
Administrative and Performance Standard Impact Total			-32		-77		-62		-128		-81		-141		-165		-118		-73		-113

Table E-4. Alternative 4 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Definition of Federal Lands Where the Regulations Apply	2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2
Notice vs. Plan of Operations Threshold	5	H-	-25	H-	-25	N	0	H-	-25	N	0	H-	-25	N	0	H-	-25	N	0	M-	-15
Definition of Casual Use	1	H-	-5	M-	-3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice and Plan of Operations Content and Processing Requirements	3	L-	-3	L-	-3	L-	-3	L-	-3	M-	-9	M-	-9	L-	-3	M-	-9	L-	-3	L-	-3
State and Federal (BLM) Coordination	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Claim Validity/Valid Existing Rights and Economic Viability	4	N	0	M-	-12	M-	-12	H-	-20	H-	-20	H-	-20	H-	-20	H-	-20	H-	-20	H-	-20
Common Variety Materials Determinations	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	M-	-6
Inspection and Monitoring Requirements	2	N	0	L-	-2	L-	-2	M-	-6	M-	-6	M-	-6	M-	-6	M-	-6	M-	-6	M-	-6
Penalties and Enforcement Procedures	3	L-	-3	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9
Financial Guarantee (Bonding) Requirements	4	N	0	L-	-4	L-	-4	H-	-20	L-	-4	H-	-20	M-	-12	H-	-20	M-	-12	L-	-4
Modifications	2	N	0	L-	-2	L-	-2	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2

Table 5-4. Alternative 4 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Temporary or Permanent Closure	2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2
Appeals Process and Stay Provisions	3	L-	-3	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15
Project Area Definition	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Applying Regulation Changes to Existing Operations	4	N	0	N	0	L-	-3	M-	-9	H-	-15	M-	-9	H-	-15	H-	-15	H-	-15	H-	-15
Administrative Impact Subtotal			-41		-75		-68		-113		-65		-110		-80		-123		-85		-89
General Performance Std/U or U Definition	5	N	0	L-	-5	L-	-5	H-	-25	M-	-15	H-	-25	M-	-15	H-	-25	M-	-15	H-	-25
Land Use Plans	3	L-	-3	L-	-3	L-	-3	L-	-3	M-	-9	M-	-9	H-	-15	M-	-9	M-	-9	H-	-15
Stability, Grading, and Erosion Control	3	L-	-3	N	0	N	0	N	0	N	0	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15
Pit Reclamation	5	N	0	N	0	N	0	L-	-5	L-	-5	H-	-25	H-	-25	N	0	N	0	L-	-5
Roads and Structures	3	N	0	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	L-	-3	N	0	N	0	L-	-3
Leaching and Mineral Processing Operations	4	N	0	N	0	N	0	N	0	N	0	M-	-12	M-	-12	M-	-12	M-	-12	L-	-4
Surface and Ground Water Protection	5	N	0	M-	-15	M-	-15	L-	-5	L-	-5	H-	-25	H-	-25	H-	-25	H-	-25	M-	-15

Table 5-4. Alternative 4 Impact on Mineral Activity by Type and Size of Operation																					
		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Acid-Forming and Other Deleterious Materials	4	N	0	N	0	N	0	N	0	N	0	H-	-20	H-	-20	H-	-20	H-	-20	L-	-4
Topsoil or Growth Medium Handling	4	N	0	N	0	N	0	N	0	N	0	M-	-6	H-	-15	M-	-6	N	0	M-	-6
Revegetation	3	N	0	H-	-15	H-	-15	H-	-15	M-	-6	M-	-6	M-	-6	M-	-6	M-	-6	M-	-6
Fish and Wildlife Protection/Restoration	3	N	0	M-	-6	M-	-6	H-	-15	M-	-6	M-	-6	M-	-6	L-	-3	L-	-3	L-	-3
Wetlands and Riparian Protection/Restoration	3	L-	-3	M-	-6	M-	-6	M-	-6	L-	-3	M-	-6	M-	-6	L-	-3	L-	-3	L-	-3
Cultural, Paleo, Cave Resource Protection	3	N	0	M-	-6	M-	-6	L-	-3	M-	-6	L-	-3	M-	-6	L-	-3	L-	-3	M-	-6
Performance Standards Impact Subtotal			-3		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]
Administration and Performance Standard Impact Total			[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]

Table E-6. Alternative 5 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Definition of Federal Lands Where Regulations Apply	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice vs. Plan of Operations Threshold	5	N	0	L-	-5	N	0	H-	-25	N	0	H-	-25	N	0	H-	-25	N	0	M-	-15
Definition of Casual Use	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice and Plan of Operations Content and Processing Requirements	3	N	0	L-	-3	L-	-3	M-	-9	L-	-3	M-	-9	L-	-3	M-	-9	L-	-3	L-	-3
State and Federal (BLM) Coordination	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Claim Validity/Valid Existing Rights and Economic Viability	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Common Variety Materials Determinations	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Inspection and Monitor-ing Requirements	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Penalties and Enforcement Procedures	3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	N	0
Financial Guarantee (bonding) Requirements	4	N	0	M-	-12	L-	-4	H-	-20	L-	-4	H-	-20	M-	-12	H-	-20	L-	-4	M-	-12

Table E-6. Alternative 5 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Modifications	2	N	0	L-	-2	L-	-2	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2
Temporary or Permanent Closure	2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2
Appeals Process and Stay Provisions	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Project Area Definition	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Applying Regulation Changes to Existing Operations	4	N	0	N	0	N	0	L-	-4	N	0	L-	-4	N	0	L-	-4	N	0	N	0
Administrative Impact Subtotal			-3		-27		-12		-45		-18		-45		-24		-45		-18		-27
General Performance Std/U or U Definition	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Land Use Plans	3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Stability, Grading, and Erosion Control	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Pit Reclamation	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Roads and Structures	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Leaching and Processing Operations	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0

Table E-6. Alternative 5 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	Wt.	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Surface and Ground Water Protection	5	N	0	N	0	N	0	N	0	N	0	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5
Acid-Forming and Other Deleterious Material	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Topsoil or Growth Medium Handling	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Revegetation	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Fish and Wildlife Protection/Restoration	3	N	0	L-	-3	N	0	M-	-6	L-	-3	L-	-3	L-	-3	L-	-3	N	0	L-	-3
Wetlands and Riparian Protection/Restoration	3	L-	-3	N	0	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	N	0	L-	-3
Cultural, Paleo, Cave Resource Protection	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Performance Standards Impact Subtotal			-3		-3		-3		-15		-6		-11		-11		-11		-5		-11
Administrative and Performance Standard Impact Total			-9		-33		-13		-39		-35		-70		-63		-79		-54		-81

A similar process was used to obtain a weight for each of the regulation components. A weight (1 through 5) was intended to scale the relative importance of each of the regulation components. For example, the regulatory provision category covering *Pit Backfilling* was considered high in relative importance and was given a weight of 5. The *Stability, Grading, and Erosion Control* category, although important, was considered relatively less important and assigned a weight of 3. Definition of the *Project Area* was assigned a weight of 1, because it was considered one of the least important provisions relative to the other issues being considered in its potential to affect mineral activity. The weights can be found in the second column, following the description of the regulation component, in each of the impact matrixes.

The EIS team then used the ratings and weighs to estimate the expected effects of the 28 regulatory categories on each sector of the industry–the "score." To simplify the scoring, a numerical value category was assigned to a particular sector of the industry. Tables E-2, E-3, E-4 and E-5 show the scores for each of the regulatory provision categories.

Table E-6 summarizes the scores for all alternatives, broken down by the effects of administrative requirements and effects attributable to the environmental performance standards. To help put these scores in context, the greatest possible score for each alternative is ±440.

Alternative 2–Using this methodology, the EIS team gave Alternative 2 a relatively small positive score for both the administrative and performance standard requirements for all categories of commercial mineral activity. None of the provisions of Alternative 2 were expected to affect casual use.

Several provisions of Alternative 2 were projected to benefit mining on public lands (Table E-2). Provisions with the highest positive scores include Notice and Plan of Operations content and processing requirements; fish and wildlife protection and restoration; wetland and riparian protection and restoration; and cultural, paleontological, and cave resource protection. These positive effects on mining mainly relate to reductions in the following: time delays for reviews and approvals, costs of content and analysis requirements, habitat restoration costs, and costs of documenting and salvaging cultural and paleontological resources.

Because Alternative 2 would rely on the state programs to regulate mining on public lands, this positive effect would not be uniform across all states. For example, California and Montana have state National Environmental Policy Act (NEPA) laws requiring comprehensive environmental review and public participation in the decisionmaking process similar to that now required on public lands under NEPA. For these two states Notice and Plan content and processing requirements would likely have minimal benefits.

Alternative 3–For most types and sizes of mining activities the proposed regulations received a relatively large negative score (Table E-3). The exception is casual use, which will be relatively unaffected by the provisions in Alternative 3.

Table E-6. Impact Score Summary on Mineral Activity by Type and Size of Operation

Alternative	Casual Use/ Suction Dredging	Exploration		Placer Mining		Open Pit Metal Mine		Underground Metal Mine		Industrial Mineral Mine
		Small <5 ac.	Large >5 ac.	Small< 5 ac.	Large >5 ac.	Small< 5 ac.	Large >5 ac.	Small <5 ac.	Large >5 ac.	All Sizes
Alternative 1 - No Action (Existing Regulations)										
Admin. Impact Subtotal	0	0	0	0	0	0	0	0	0	0
Perf. Std. Impact Subtotal	0	0	0	0	0	0	0	0	0	0
Alternative 1 - Total	0	0	0	0	0	0	0	0	0	0
Alternative 2 - State Management										
Admin. Impact Subtotal	0	16	29	18	29	18	29	18	23	25
Perf. Std. Impact Subtotal	0	27	27	39	39	33	39	24	39	45
Alternative 2 - Total	0	43	56	57	68	51	68	42	62	70
Alternative 3 - Proposed Regulations (Proposed Action and Preferred Alternative)										
Admin. Impact Subtotal	-13	-49	-23	-69	-34	-73	-34	-73	-26	-55
Perf. Std. Impact Subtotal	-9	-28	-29	-59	-47	-68	-74	-43	-47	-58
Alternative 3 - Total	-22	-77	-52	-128	-81	-141	-108	-116	-73	-113

Table E-6. Impact Score Summary on Mineral Activity by Type and Size of Operation (continued)

Alternative 4 - Maximum Protection										
Admin. Impact Subtotal	-41	-79	-52	-113	-86	-119	-88	-125	-88	-99
Perf. Std. Impact Subtotal	-9	-74	-74	-89	-73	-179	-181	-133	-114	-119
Alternative 4 - Total	-50	-153	-126	-202	-159	-298	-269	-258	-202	-218
Alternative 5 - NRC Recommendations										
Admin. Impact Subtotal	-3	-27	-12	-65	-16	-65	-24	-65	-16	-37
Perf. Std. Impact Subtotal	-6	-6	-6	-15	-9	-14	-14	-14	-8	-14
Alternative 5 - Total	-9	-33	-18	-80	-25	-79	-38	-79	-24	-51

451

Small mining operations, specifically those that are now Notice-level operations, will face several new requirements, including the Notice/Plan threshold and financial guarantee provisions. These requirements will result in costly changes to most small mining operations. All exploration and mining will potentially be affected by the new definition of unnecessary or undue degradation. As a management tool the effect on mining would logically be felt by both large and small operations. As a basis for challenging BLM decisions, large mines that are subject to public scrutiny would likely be the most affected. The extent of the effect on mineral activity is speculative and will likely not be known for many years. This unknown aspect of the provision will contribute to the uncertainties of and have a negative effect on mineral activity.

The pit backfilling provision in the proposed regulations is the environmental performance standard most likely to harm mining operations. The use of the non mitigateable significant irreparable harm standard in the undue and unnecessary definition will also potentially harm the mining operations. Because implementing these provisions would depend on site-specific conditions and the discretion allowed BLM, it is difficult to even qualify the size of the effect across the industry. Clearly, these provision have the potential to greatly affect individual open pit mines.

Alternative 4–Alternative 4 would impose the greatest administrative burden and generally has the highest environmental performance standards of all alternatives considered in this EIS (Table E-4). For most mining and exploration on the public lands Alternative 4 would have a higher adverse effect than the other alternatives. For casual use this alternative received a relatively small negative score.

Both administrative and performance standards under Alternative 4 would have a relatively high adverse effect. The administrative requirements with the greatest negative effect on mining under Alternative 4 include the Notice/Plan threshold, financial guarantees, claim validity, appeals process, and applying the new regulations to existing operations. The change to the Notice/Plan threshold would affect only operations that would be Notice-level operations under the existing regulations. The other provisions would harm operations regardless of size. Most all of the environmental performance standards would have a moderate to high adverse effect on some segment of the industry. Mandatory pit backfilling, for example, would have an extremely high negative effect on open pit mining. At the same time the backfilling provision would at most only slightly affect some other forms of mineral activity.

Alternative 5–Small mining operations, specifically those that are now Notice-level operations, will be subject to new Notice/Plan threshold and financial guarantee requirements under this alternative. These two requirements will result in costly changes to most small mining operations. Mines that are not affected by these two provisions will go relatively unaffected by this alternative. Notice-level exploration will be subject to the financial guarantee requirement but not the requirement to prepare a Plan of Operations. As such, small exploration received a relatively small negative score.

MINE COST MODELS

Regulation changes generally affect the mining industry economically. Effects involve such environ-mental costs as permitting and reclamation, and the time value of money. To determine how these regulatory alternatives will affect operators and the mining industry, mine cost models were developed to estimate general costs of mining for analysis purposes. These models are theoretical and highly general. They do not represent any existing operations. Using the mineral activities and various types of mining methods on public lands, one cannot reasonably model all the scenarios. The models presented here are an attempt to represent the basic range of activities from casual use to major mining projects in relation to the 43 CFR 3809 regulations. The models are for analysis purposes only to show the general economic impact of the regulation alternatives. The models are for the following types of operations:

- Casual use.
- A small exploration operation of less than 2.5 acres.
- An exploration project up to 5 acres.
- A small placer operation of 2.5 acres.
- A larger placer operation exceeding 5 acres.
- A small mining operation under 5 acres.
- A larger mining operation exceeding 5 acres.

The following data and assumptions are used to develop these models.

1. The operating and capital costs were developed from reference models presented in *Mining Cost Services* (Western Mine Engineering, Inc. 1997), section CM, Cost Models.

A. The following items are included in operating and capital costs:
- All labor, material, supply, and equipment operation costs incurred at the mine or mill site, including supervision, administration, and onsite management.
- Benefits and employment taxes.
- All onsite development.
- Mine and mill equipment and facilities, purchases, and installation or construction.
- Limited haul road construction.
- Engineering and construction management fees.
- Working capital.
- Tailings disposal.

B. The following items are not included in operating and capital costs:
- Exploration.
- Permitting and environmental analysis costs.
- Contingencies.
- Access roads, power lines, pipelines, or railroads to the mine and mill site.
- Home office overhead.
- Taxes (except sales taxes).
- Insurance.

- Depreciation.
- Townsite construction or operation.
- Offsite transportation of products.
- Incentive bonus premiums.
- Overtime labor costs
- Sales expenses.
- Smelting and refining costs (except ore production at hydro metallurgical mills).
- Interest expenses.
- Startup costs (except working capital).

2. Permitting, environmental, and reclamation costs are estimated from BLM experience in Nevada, Alaska, and Montana.

3. The equipment used to develop and extract ore from the mine will also be used in reclamation.

4. The costs described in these models will be generally borne by the industry and not BLM. On the basis of site-specific factors and implementation decisions, some of these costs may be borne by BLM or the operator. Operations that are not complex and do not require costly information to process the environmental documentation and reviews may not result in cost increases to the operator. These operations usually are small exploration projects, small placer operations, and non-complex mines. Costs are estimated for analysis purposes in these models.

5. Placer model costs are derived from Montana Placer Mining BMPs (best management practices) SP 106 and Environmental Protection Agency, Economic Impact Analysis of Final Effluent Limitations Guidelines and Standards for the Gold Placer Mining Industry.

6. Time delays are not addressed as costs in the mine cost models. The effect of time delays are addressed in the discount cash flow analysis presented in the following section. It is assumed that operators will submit complete documents in a timely manner and that BLM will process projects in a timely manner. This is not always the case. We recognize the importance of uncertainties, delays, and lengthy permitting processes as negative factors affecting the economics of mineral exploration and development. These factors can become so onerous that individual projects may be abandoned. The models address known permitting time increases from the regulation provisions, but most aspects of cost of delays are project specific and not conducive to programmatic analysis.

7. Operators will comply with the regulations.

8. Acres disturbed are averages based on actual mine plans and notices submitted to BLM.

9. Costs for equipment were derived from *Rental Rate Blue Book* by K-III, *Mine and Mill Equipment Cost* by Western Mine Engineering, Inc. (1997a) and from bond calculations accepted by BLM.
10. Labor costs were derived from *Mining Cost Service* by Western Mine Engineering, Inc. (1997b), Davis and Bacon Wage Grade tables, and bond calculations accepted by BLM.

11. This analysis assumes that these costs will not be affected by regulation changes. Regulation changes for this analysis will affect permit authorizations and reclamation and closure aspects of mining.

12. Reclamation costs for this analysis include chemical stabilization, removal of equipment and structures, earth work, erosion and water controls, and revegetation.

13. Permit and environmental costs are averages obtained from the mining industry, environmental consultants, and BLM offices. These costs include all costs of preparing environmental documents under the National Environmental Policy Act, cultural work under the Archaeological Resources Protection Act, and other legal requirements to permit operations under existing regulations. Each type of document could have a wide range of cost based on the complexity of the issues being addressed on the site. For example, during the survey for this document showed that the cost of an EA can range from $0 to $200,000 and of an EIS from $50,000 to $2,200,000. For this model exercise it was determined that only one price for each type of document would be used to show an incremental cost of these regulations. But it will be noted in some models where BLM thinks costs would be lower on the basis of the type of project and model.

14. Financial guarantee costs are based on current BLM practice. No bonding is required for Notice-level operations. Exploration Plans of Operations are bonded at cost or $1,000/acre, whichever is lower. Mining Plans of Operations are bonded at 100% of the cost for closing and reclaiming mines that used chemical processing or have ARD potential. Other mining areas are bonded at the ~~and~~ cost of reclamation or $2,000/acre, whichever is lower.

15. Stream restoration costs were derived from the *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991), prepared for the U.S. Environmental Protection Agency. The "stream and floodplain reconstruction" was used as the cost figures in these models.

16. The amount of material (topsoil, waste rock) has been estimated for analysis purposes. The estimates will be used from model to model to show estimated changes in cost.

17. The mine models do not spread costs through the years of the project but assume that the capital costs will be accrued in years 1 and 2, operating costs over the life of the project, reclamation costs in the last 2 years of the project, and environmental and permitting costs in the first year.

18. The cost of a validity exam is used for the cost of conducting a feasibility study under Alternative 4.

19. The following cost calculations assume that the state program is similar to the State of Nevada program. A review of state programs found that most states appear to be similar in posting bonds for reclamation and in reclamation and surface and ground water requirements.

States appear generally not to review operations smaller than 5 acres but to require reclamation.

As discussed above, the main areas of impacts to the industry are in reclamation and permit/ environmental compliance. To better understand these relationships, the following theoretical costs have been derived for the models above. These costs were used as a basis for estimating economic changes in mining.

Casual Use Operations

The term of casual use is defined as mineral activities that only negligibly disturb federal lands and resources. Casual use does not include the use of mechanical earth-moving equipment or explosives or the use of motorized equipment in areas closed to off-road vehicles.

In general, casual use includes most of the initial exploration activities of prospectors and independent geologists. As described in Chapter 3, Development of Mineral Properties, the development of a mine from grassroots explorations to production is done is several phases. The beginning operations include reconnaissance work, small exploration and prospecting. On the ground work for exploration include grab samples, geophysical exploration, stacking claims, soil samples taken with hand augers, and geochemical samples. On-the-ground prospecting includes pick and shovel work on claims, panning and rocker box type exploration, and rock collecting. All of these activities are included in casual use operations.

Alternative Analysis

Alternatives 2, 3, and 5 would not change the ability of the independent geologist and prospector to engage in casual use. There will be no cost to the companies from the requirements in these alternatives. These three alternatives would not restrict the operator from conducting early reconnaissance, exploration, and prospecting. Alternative 4 does not change the definition of casual use but does require the operator to consult with the BLM on all activities other than claim staking. This consultation will determine if the activity is casual use or if a Plan of Operations is required. For this analysis we assume the ability of the independent geologist and prospector to use casual use under Alternative 4.

Small Exploration Project

The small exploration project is the next type of operation that develops and delineates the potential mineral deposit. The operator is usually a independent geologist or small mining/exploration company that explores for undiscovered deposits and sells interests in these deposits to major mining companies.

In developing the property, the prospector or independent geologist may be developing the information and property in hopes or selling them to a major company. Because these entities hope to realize their profit with the sale of the property and information, they do not pay themselves wages for their work. Under this scenario the cost of the operation would be

#56

decreased by the wage of the project geologist.

Project size:	1 to 2 acres
Project life:	Less than 1 month
Proposed evaluation methods:	Drill holes (10), for this model an average of 200 feet deep
Equipment:	Truck mounted, self-contained drill
Permitting:	Notice-level, 15 days to complete; no federal/state joint coordination needed. Note: this operation could require a Plan of Operations if located on special category lands.
Reclamation:	Recontouring and revegetation, stream restoration, immediately after drill hole evaluation.

Permitting Cost: Under this operation the independent geologist will submit the Notice to BLM. The Notice usually is hand written, includes a map, and would take 4 hours to compile and provide to BLM. The estimated cost would be $200. But the document could vary in size and technical sophistication. Permitting and environmental costs can be difficult to estimate because they can vary greatly by site-specific conditions. Depending on the ore body sought, its location, and other local environmental conditions, the cost can cover a broad range.

Operation Cost: The operation would include one track-mounted drill rig with driller and helper. The project geologist would also be present at the site and would require two 4X4 pickups to transport workers to and from the site. There would be a mobilization and demobilization cost to haul equipment to and from the site. The driller would be able to drill one of more holes per day and complete reclamation by filling the drill holes and spreading the drill cuttings out. The project would be completed in one work cycle of 10 days at 10 hours per day.

This model assumes no capital expenditure for this operation. The company or individuals would pay rental or operational costs. For this operation, it is assumed that the truck is owned by the project geologist and the drilling rig is rented or leased.

Capital Cost	$0.00

Operating Costs

Track Drill Rig	$4825.00/week for two weeks	$9,650
4X4 pick up	$160.00/week for two weeks	$320
Mobilization and Demob	$500.00/vehicle	$500
	Total	$10,470

Labor

Driller	$40.00/hr for 10hrs/day at 10 days	$4,000
Laborer	$28.00/hr for 10hrs/day at 10 days	$2,800
	Total	$6,800

Reclamation Cost: The main reclamation would be plugging the drill holes and cleaning up the drill cuttings. For the purpose of this model the 10 holes are dry and require only backfilling. The operator will take a half hour to plug the hold and spread out the drill cuttings, and this would be completed during the drilling operations. The project geologist would be required to visit the site once to get environmental compliance, and this visit would require a full day at $25/hr for 10 hours for an added reclamation cost of $250.

This model assumes that the exploration holes were drilled either on existing roads and trails or cross county with no road building. Therefore, no more reclamation would be required.

Table E-7. Exploration Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting (Notice Preparation)	Project Geologist	$200	$200
Exploration Activity:			
Operating Cost - Labor			$6,800
Operating Cost - Equipment			$10,470
Exploration Activity Total			$17,270
Reclamation:			
Site visit	Project Geologist	$25.00/hr	$250
Total Cost of Exploration Project			$17,670

Alternative 1: Current Management

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: The following cost calculations assume that the state program is closely based on current State of Nevada regulations, with a few differences. A review of state programs found that most states appear to be similar in posting bonds for reclamation and in reclamation and surface and ground water requirements. States appear generally not to review operations smaller than 5 acres but to require reclamation.

This analysis assumes that the state will not require that any information be submitted because the project occupies less than 5 acres. The state will still require reclamation and will monitor the activity area for compliance.

Permitting and Environmental Costs: The operator would not have to submit a Notice to BLM and usually would not have to submit anything to the state. The operator would therefore save the direct cost of document preparation. An operator making project changes would save time by not having to contact BLM. By not having to prepare a Notice, the operator would save about $200.

Reclamation Costs: This analysis assumes that the state requires reclamation. The reclamation would be complete at the end of the operation and would not need a compliance inspection.

Total Estimated Cost Changes: Total cost savings for this exploration project under Alternative 2 are summarized in Table E-8.

Table E-8. Alternative 2: Changes in Costs for Small Exploration Project

Total Project Cost under Alternative 1 (Existing regulations)	$17,670
Change in Costs under Alternative 2 due to	
Elimination of Notice Preparation	(200)
No Compliance Inspection	(250)
Total Change in Costs under Alternative 2	(450)
Total Project Cost under Alternative 2 (State Management)	$19,870
Percent Change in Costs from Alternative 1 to Alternative 2	- 2 %

Alternative 3: Proposed Action

General: Alternative 3 would establish outcome-based performance standards. This approach outlines to the industry what standards must be met on public lands but lets operators determine how to meet these standards. Impacts to exploration would be slight because BLM and industry are already generally following these procedures in authorizing operations and accepting reclamation. The operation would be bonded for reclamation, and the operator could incur costs for noncompliance and could pay penalties.

Depending on the location of the operation, the operator could be required to submit a Plan of Operations. Where a Notice-level operation would be required to submit a Plan of Operations represents the greatest potential cost increase under Alternative 3. In addition, for withdrawn lands a validity exam would be required and may involve costs to the operator. We assume these types of actions would not occur often.

Permitting and Environmental Costs: The costs that could be incurred under the Proposed Action would be the cost of bonding a Notice and the costs resulting from operations being in areas classified as sensitive and required to submit Plans of Operations.

Processing Content - Alternative 3 generally would allow the operation to remain a Notice. The cost of preparing the Notice would not change. If a Plan of Operations is required, the project would be delayed. This model assumes that more information would be required. The project geologist would take an estimated 2 days to prepare the maps and get the information needed for the Plan of Operations, $1,000 in labor and materials.

Bonding - Bonding would be required at 100% of the reclamation cost to be performed by a third party (not the operator). One laborer would have to drive to the location and fill the drill holes and rake out the drill cuttings, and a $500 cash bond would have to be submitted to BLM.

Notice Versus Plan Threshold - Under the Proposed Action, requirements for filing Plans of Operations or Notices would be expanded. More categories of exploration would need Plans of Operations. If the exploration project goes to a Plan, the company would experience extensive time delay and costs. The cost of the environmental assessment by a third-party contractor would range from $10,000 to $100,000, depending on the complexity of the operation. For this type of project, it is assumed the document cost is $10,000.

Normally, on an operation of this size BLM would complete the NEPA document. But this model assumes that the operator will bear the cost of preparing the document, $10,000. The document would be completed within the 30 days time frame.

Validity Exams - This provision requires that BLM conduct a validity exam before approving a Plan of Operations within an area withdrawn from the mining laws. These operations are statistically few but do exist on the public lands. The major concern and cost to the operator is the delay of processing the exam. The companies would not usually pay for the mineral exam but must support the mineral examiner in preparing the report. The average cost to BLM of conducting a validity exam is about $10,000. For this analysis we assume that BLM would recover the cost of the validity exam from the operator. Few operations would be subject to validity exams; 2% of mining activities are assumed to require this additional cost.

Reclamation Costs: No additional reclamation costs would be required under Alternative 3.

Total Estimated Cost Changes: If the exploration operation is in an area that has not been withdrawn from the mining laws and does not require a Plan of Operations, the exploration company would bear no additional cost under the Proposed Action beyond the cost of bonding. But if the project needs to submit a Plan of Operations or the area of exploration has been withdrawn from mineral entry, the operator would have to pay for a third-party environmental assessment (EA), and a validity exam would be required before operations could begin. Estimated cost changes are summarized in the Table E-9.

Table E-9. Alternative 3: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1	$17,670
Change in Costs under Alternative 3 due to Bonding Total Change in Costs under Alternative 3	 $500 $500
Total Project Costs under Alternative 3	20,820
Percent Change in Costs from Alternative 1 to Alternative 3	2%
Change in Costs Assuming Plan of Operations Required and Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Bonding Plan Preparation Environmental Assessment Validity Exam Total Change in Costs under Alternative 3	 500 1,000 10,000 10,000 21,500
Total Project Costs under Alternative 3	$41,820
Percent Change in Costs from Alternative 1 to Alternative 3	106%

Alternative 4: Maximum Protection

General: Alternative 4 is based on design standards that establish specific criteria for protecting environmental resources. These types of standards and criteria would affect exploration operations. The elimination of Notices would directly affect an exploration project in bonding, inspection, and enforcement; soil stability; topsoil; drill hole plugging; and revegetation. The need for a validity exam, bonding criteria, fish and wildlife habitat, and wetlands would affect exploration.

This model assumes that the operator would comply with the regulations and therefore pay no penalties. The automatic stay for appeals under Alternative 4 could delay exploration as well as potential future profits if an economic deposit is discovered. The cost to the operator of the delays are addressed in the discount cash flow analysis in the next section.

Permitting and Environmental Costs: The standards for road construction were developed for well-maintained roads and not for exploration roads. It is assumed that road building will be based on site conditions.

Bonding - Bonding would be as outlined for Alternative 3 but would include more costs for unplanned events (spills, releases, and cleanup). For exploration projects added costs for major environmental problems would probably not need to be addressed except for potential petroleum spills. Any petroleum spill would require removing contaminated soils and trucking them to an approved disposal site for treatment. The potential cost would be added to the bond amount. The exploration model assumes that the operator would place the full amount of the bond into a certified deposit. The operator would again get a bond through a bonding company. The total estimated bond amount would be $1,500, and the estimated cost of reclamation would amount to $500 for general reclamation as described for Alternative 3, plus $1,000 more for a potential unplanned petroleum spill.

Notice Versus Plan Threshold - Under Alternative 4, Notice-level operations and all other mineral activity, including exploration, would be replaced by Plans of Operations. The cost of developing and reviewing Plans would apply as outlined for Alternative 3. Estimated costs for an exploration project to file a Plan of Operations would total about $11,000 ($1,000 for preparing a Plan of Operations and $10,000 for preparing an environmental assessment of small complexity, with costs borne by the operator).

Inspections - Under Alternative 4, operators would be required to hire third-party contractors to monitor their operations. This project would require three inspections: once during exploration, once during reclamation, and once for final reclamation and clearance. The monitoring would not require an overnight stay, but 10 hours would be needed to get to the site, complete the inspection, and return to the office and complete the report. No samples would be needed for this program. Total estimated costs for inspection would amount to $1,500 (assuming one inspector, three trips, 10 hours/trip, at $50/hr).

Validity Exams - This provision requires that a validity exam be conducted before a Plan of Operations is approved. This cost would remain the same as outlined for Alternative 3. The average cost to BLM of conducting a validity exam is $10,000. BLM would recover the cost of the validity exam from the operator.

Reclamation Costs: Reclamation for wetlands and fish and wildlife habitat would remain the same for this model as under Alternative 1, No Action. The assumption is that the mining industry overall would be diligent and disturbances would be reclaimed within the 10-year limit. Therefore, no other habitat restoration would be required, and no more costs are assumed.

This is a short-term exploration project, and soil stability design limits would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but no added cost of erosion control blankets would be needed above erosion and sediment control structures.

Water Resources - For the exploration model 50 drill holes would be drilled with a diameter of 5.5 inches. This holes are assumed to be dry. Under Alternative 4 the holes would be plugged with bentonite and 10 feet of cement. Total estimated cement capping costs would amount to $1,250 (assuming 50 holes, 10 feet/hole, at $2.50/linear foot). Total estimated plugging costs would amount to $16,150 (assuming 190 feet/hole, at $1.70/linear foot).

Revegetation - No additional reclamation costs would be required under Alternative 3.

Total Estimated Cost Changes: If the exploration operation is not in an area withdrawn for minerals, the project would incur the costs shown in Table E-10.

Table E-10. Alternative 4: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1:	$17,670
Change in Costs under Alternative 4 due to:	
Bonding	1,500
Plan Preparation	1,000
Environmental Assessment	10,000
Third-Party Monitoring	1,500
Drill hole Plugging	17,400
Validity Exam	10,000
Total Change in Costs under Alternative 4:	$41,400
Total Project Costs under Alternative 4:	$61,720
Percent Change in Costs from Alternative 1 to Alternative 4:	203%

Alternative 5: NRC Recommendations

General: A small exploration project would continue to be allowed as a Notice-level activity. The costs that could be incurred under Alternative 5 would be the cost of bonding a Notice. Therefore, the operator would be required to post a cash bond of $500.

Table E-11. Alternative 5: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1	$17,670
Change in Costs under Alternative 3 due to Bonding	$500
Total Change in Costs under Alternative 3	$500
Total Project Costs under Alternative 3	20,820
Percent Change in Costs from Alternative 1 to Alternative 3	2%

Exploration Model

463

This operation is run by a medium-sized exploration company that owns its equipment or rents all of its equipment. This operation will have no major capital costs. The model assumes the exploration is for precious or base metals.

Project size:	4 acres disturbed
Project life:	Less than 6 months
Proposed evaluation methods:	Drilling (50 holes) and trenches (5) @ 100'x5'x0'
Equipment:	Truck-mounted self-contained drills, tracked excavator (Cat 231D), dozer (Cat D7H)
Permitting:	Notice-level, 15 days to complete; no federal/state joint coordination needed. Note: This operation could require a Plan of Operations depending on alternative or whether the operation is located on sensitive lands.
Reclamation:	Recontouring and revegetation, stream restoration, immediately after completion of drill hole/trenching evaluation.

Permitting and Environmental Costs: Permitting and environmental costs are difficult to determine by a generalized method. The costs of permit authorizations and environmental documentation vary greatly because of site-specific conditions. Depending on the ore body sought, its location, and other local environmental conditions, the costs can cover a broad range. For the following costs, several mining companies and consultant firms were contacted, and average costs were derived. These costs are described below and are detailed in Table E-12.

This exploration operation would file a Notice, and no bond or environmental documents would be required. All actions would be handled by the local BLM office with which the Notice is filed. The only cost to the operator would be to prepare the document to be submitted to BLM. Two people would need 3 days with AutoCAD support to complete the documentation for the Notice, at a cost of $1,000.

Reclamation Costs: Earthwork would include ripping all roads and drill pads, recontouring roads and pads, and plugging drill holes. The work would take 20 hours to complete. Each piece of equipment would operate for 10 hours. The 50 dry drill holes, 200 feet deep, would be backfilled with drill cuttings. This work would take one operator an extra half hour to complete. Equipment needs include a bulldozer and a tracked excavator at a cost of $2,200. Labor costs are estimated to total $1,600 for two equipment operators. Drill hole plugging is estimated to result in added labor costs of $100. For revegetation, no ground preparation is needed for seeding. The model assumes that the project is completed during good seeding times of the year. The seed mixture would be a combination of native and exotic plants as outlined in the open pit model. The priority is to stabilize the soil. An estimated 4 hours would be needed for seeding. Because of the nature of this operation, chemical stabilization and removal of structures would not be needed.

Table E-12. Exploration Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting (Notice Preparation)	2 people, 3 days each	$500 ea	$1,000
Exploration Activity:			
Operating Cost - Labor			50,000
Operating Cost - Equipment			150,000
Exploration Activity Total			200,000
Reclamation:			
Earthwork			
Equipment	1 dozer (Cat D7H) - 10 hrs	120/hr	1,200
	1 tracked excavator (Cat 231D) -10 hrs	100/hr	1,000
Labor	2 equipment operators, 20 hrs each	40/hr each	1,600
Drill holes (50)	1 operator, 2.5 hrs	40/hr	100
Revegetation			
Seed Mixture	4 acres	56/ac	225
Labor	1 laborer, 4 hrs	28/hr	112
Miscellaneous			
Mob/Demob	2 vehicles	500/vehicle	1,000
Supervision			
Equipment	½ ton 4X4 pickup, 1 day	40/day	40
Labor	environmental manager, 8 hours	25/hr	160
Reclamation Total			5,437
Total Cost of Exploration Project			$207,337

Miscellaneous Costs: The equipment to complete reclamation is assumed not to be located at the site. Therefore, mobilizing and demobilizing the equipment would involve more costs to industry. The operation usually would require 8 hours of supervision (employed by the company) to ensure that reclamation is completed correctly.

Alternative 1: Current Management

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2 - State Management

Estimating costs for this alternative for each of the 12 states in the study area would be impractical for this exercise. Therefore, the following cost calculations assume that the state program is closely based on current State of Nevada regulations with a few differences. A review of state programs found that most states appear to be similar in posting bonds for reclamation and in reclamation and surface and ground water requirements. States appear generally not to review operations smaller than 5 acres but to require reclamation.
This analysis assumes that the state will not require any information to be submitted because the project occupies less than 5 acres. The state will still require reclamation and monitor the activity area for compliance.

Permitting and Environmental Costs: The operator would not have to submit a Notice to BLM and usually would not have to submit anything to the state. The operator would therefore save the direct cost of document preparation. An operator making project changes would save time by not having to contact BLM. By not having to prepare a Notice, the operator would save about $1,000 (assuming Notice preparation would take two people 3 days to complete).

Reclamation Costs: This analysis assumes that the state requires reclamation. The company would have to reclaim any disturbance from its operation. The analysis also assumes that reclamation would not require restoring wildlife and fisheries habitat. For exploration operations this restoration could be represented by the types of seed mixtures used. The analysis assumes that the state will require only grasses to stabilize soils. Using the seed mixture in the open pit model and using only the grasses in the mixture would bring the cost to only $28/acre instead of $56/acre. A total of $112 would be saved on revegetation costs (assuming per-acre savings of $28 for the seed mixture).

Total Estimated Cost Changes: Total cost savings for this exploration project under Alternative 2 are summarized in Table E-13.

Table E-13. Alternative 2: Changes in Costs for Small Exploration Project	
Total Project Cost under Alternative 1 (Existing regulations)	$207,337
Change in Costs under Alternative 2 due to	
Elimination of Notice preperation	(1,000)
Change in Seed Mixture	(112)
Total Change in Costs under Alternative 2	(1,112)
Total Project Cost under Alternative 2 (State Management)	$206,225
Percent Change in Costs from Alternative 1 to Alternative 2	- 1%

Alternative 3: Proposed Action

General: Alternative 3 would establish outcome-based performance standards. This approach outlines to the industry what standards must be met on public lands but lets mine operators determine how to meet these standards. Impacts to exploration would be slight because BLM and industry are already generally following these procedures in authorizing operations and accepting reclamation. Industry will have no costs for paying penalties.

Any operation within a mineral withdrawal area would have the extra cost of time and money for completing a validity exam of mining claims. These types of actions would not occur often and are assumed for this model to be addressed as no cost.

Under the Proposed Action, the most significant potential change would be the possibility that this Notice-level operation would now be required to submit a Plan of Operations.

Permitting and Environmental Costs: The greater cost under the Proposed Action would mainly be the cost of bonding a Notice. Other costs could result from operations in areas now being classified as sensitive.

Bonding - Bonding would be strengthened to include bonding of Notices at 100% of the reclamation cost. Plans of Operations would be bonded at 100% of the reclamation cost. Bonding would be used to pay for site reclamation if operators cannot fulfill their reclamation obligations. This model assumes that the operator is obtaining the bond from a bonding agency and would pay only a certain percentage for the bond amount. The total amount of the bond is estimated to be $272, or 5% of reclamation costs ($5,437 @ 5% = $272/year).

Notice Versus Plan Threshold - Under the Proposed Action, requirements for filing Plans of Operations or Notices would be strengthened. More categories of exploration would need Plans of Operations than before.

Estimated costs for an exploration project that would be required to file a Plan of Operations would total about $82,500 ($2,500 for preparing a Plan of Operations and $80,000 for preparing an environmental assessment of moderate complexity, with costs borne by the operator).

Processing Content - Alternative 3 could delay and increase costs for exploration projects having short turnaround times. The model assumes that the Proposed Action would result in no costs of delay if industry plans reasonably well and BLM's processing of the Notice is timely. Time delays of from 15 to 30 days for approval should not increase costs. But problems could result if delays are not scheduled and the operation assumes the cost of standby time for drill rigs and workers. BLM's late processing of permits could add to this cost. No delays are assumed for this model.

Validity Exams - This provision requires that BLM conduct a validity exam before approving a Plan of Operations within an area withdrawn from the mining laws. These operations are statistically few but exist on the public lands. The major concern for industry is the delay of processing the exam. The companies would not usually pay for the mineral exam but must support the mineral examiner in preparing the report. The average cost to BLM of conducting a validity exam is about $10,000. BLM would recover the cost of the validity exam from the operator. Few operations would be subject to validity exams; only 2% of mining activities are assumed to require this additional cost.

Reclamation Costs: No additional reclamation costs would be required under Alternative 3.

Total Estimated Cost Changes: If the exploration operation is in an area that has not been withdrawn from the mining laws and does not require a Plan of Operations, the exploration company would bear no additional cost with proper coordination. But if the project needs to submit a Plan of Operations and the area of exploration has been withdrawn from mineral entry, the operator would have to pay for a third-party environmental assessment (EA), and a validity exam would be required before operations could begin. Estimated cost changes are summarized in the Table E-14.

Table E-14. Alternative 3: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1	$207,337
Change in Costs under Alternative 3 due to Bonding @5	1,360
Total Change in Costs under Alternative 3	1,360
Total Project Costs under Alternative 3	208,697
Percent Change in Costs from Alternative 1 to Alternative 3	0%
Change in Costs Assuming Plan of Operations Required and Validity Exam is Conducted	
Change in Costs under Alternative 3 due to	
Bonding	1,360
Plan Preparation	2,500
Environmental Assessment	80,000
Validity Exam	10,000
Total Change in Costs under Alternative 3	93,860
Total Project Costs under Alternative 3	$301,197
Percent Change in Costs from Alternative 1 to Alternative 3	45%

Alternative 4: Maximum Protection

General: Alternative 4 is based on design standards that establish criteria for protecting environmental resources. These types of standards and criteria would affect exploration operations. The elimination of Notices would directly affect an exploration project in bonding, inspection, and enforcement; soil stability; topsoil; drill hole plugging; and revegetation. The need for a validity exam, bonding criteria, fish and wildlife habitat, and wetlands would affect exploration.

This model assumes that the operator would comply with the regulations and therefore pay no penalties. The automatic stay for appeals under Alternative 4 could delay exploration as well as potential future profits if an economic deposit is discovered. Delays are addressed in the following discount cash flow analysis.

Permitting and Environmental Costs: The standards for road construction were developed for well-maintained roads and not for exploration roads. It is assumed that road building will be based on site conditions.

Bonding - Bonding would be as outlined for Alternative 3 but would include more costs for unplanned events (spills, releases, and cleanup). For exploration projects added costs for major environmental problems would probably not need to be addressed except for potential petroleum spills. Any petroleum spill would require removing contaminated soils and trucking them to an approved disposal site for treatment. The potential cost would be added to the bond amount. The exploration model assumes that the operator would place the full amount of the bond into a certified deposit. The operator would again acquire a bond through a bonding company. If the operator can get good company ratings, the bond will cost 2% of the bond amount for 1 year. The total estimated bond amount would be $6,437, and the estimated cost of reclamation would amount to $5,437 for general reclamation as described in Alternative 3, plus $1,000 more for a potential unplanned petroleum spill. The total bond cost is estimated to be $322, or 5% of reclamation costs ($6,437 @ 5% = $322).

Notice Versus Plan Threshold - Under Alternative 4, Notices and all mineral activity, including exploration, would be replaced by Plans of Operations. The cost of developing and reviewing Plans would apply as outlined for Alternative 3. Estimated costs for an exploration project to file a Plan of Operations would total about $82,500 ($2,500 for preparing a Plan of Operations and $80,000 for preparing an environmental assessment of small complexity, with costs borne by the operator).

Inspections - Under Alternative 4 operators would be required to hire third-party contractors to monitor their operations. This project would require three inspections: once during exploration, once during reclamation, and once for final reclamation and clearance. The monitoring would not require an overnight stay, but 10 hours would be needed to get to the site, complete the inspection, and return to the office and complete the report. No samples would be needed for this program. Total estimated costs for inspection would amount to $1,500 (assuming one inspector, three trips, and 10 hours/trip, at $50/hr).

Validity Exams - This provision requires that a validity exam be conducted before a Plan of Operations is approved. This cost would remain the same as outlined for Alternative 3. The average cost to BLM of conducting a validity exam is $10,000. BLM would recover the cost of the validity exam from the operator.

Reclamation Costs: Reclamation for wetlands and fish and wildlife habitat would remain the same for this model as under Alternative 1, No Action. The assumption is that the mining industry overall would be diligent and disturbances would be reclaimed within the 10-year limit. Therefore, no other habitat restoration would be required, and no more costs are assumed.

This is a short-term exploration project, and soil stability design limits would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but no added cost of erosion control blankets would be needed above erosion and sediment control structures.

Water Resources - For the exploration model 50 drill holes would be drilled with a diameter of 5.5 inches. This holes are assumed to be dry. Under Alternative 4 the holes would be plugged with bentonite and 10 feet of cement. Total estimated cement capping costs would amount to $1,250 (assuming 50 holes, 10 feet/hole, at $2.50/linear foot). Total estimated plugging costs would amount to $16,150 (assuming 190 feet/hole, at $1.70/linear foot).

Topsoil - Under Alternative 4 the topsoil would be removed by soil horizons. The operator would remove the topsoil the same as under the other alternatives, but possible increases in travel time to stockpile locations could decrease the efficiency of the earth moving equipment by not allowing the blade to take as deep a cut as possible. These increases would not substantially increase the time needed to remove topsoil.

Under the other alternatives the soil and colluvium would be moved by the earth moving equipment in one or two passes, mixing the material together. The material would be removed to different locations on either side of the road or drill pads. The travel distance would remain the same, but the efficiencies of the equipment would decrease. The efficiencies were estimated from the Caterpillar Performance Handbook (Caterpillar, Inc. 1996) as 0.83. For Alternative 4 the efficiency is estimated at 0.75 or about 1 hour difference in the time needed to complete the dirt work. Total estimated added costs for equipment and labor to complete dirt work is $300 (assuming another hour each for one dozer at $120/hr and one tracked excavator at $100/hour, and two equipment operators for 1 hour each at $40/hr).

Revegetation - Under Alternative 4 revegetation would consist of only native species seed planted. The open pit model outlines the seed mixture used under this alternative. All other aspects of seeding the exploration project would remain the same as under Alternative 1 (No Action). Total estimated added costs would be $155 (assuming an added seed mixture cost of about $39/acre for 4 acres).

Total Estimated Cost Changes: If the exploration operation is not in an area withdrawn from mineral development, the project would incur the costs shown in Table E-15.

Table E-15. Alternative 4: Change in Costs for Small Exploration Project

Total Project Cost under Alternative 1:	$207,337
Change in Costs under Alternative 4 due to:	
Bonding	322
Plan Preparation	2,500
Environmental Assessment	80,000
Third-Party Monitoring	1,500
Drill hole Plugging	17,400
Topsoil Management	300
Revegetation with Natives	155
Validity Exam	10,000
Total Change in Costs under Alternative 4:	112,177
Total Project Costs under Alternative 4:	$319,514
Percent Change in Costs from Alternative 1 to Alternative 4:	54%

Alternative 5

General: Under Alternative 5 the operation would continue to be processed under a Notice. The only change would be the addition of a bond to the operation. Under this model the bond cost would be as outlined in Table E-16.

Total Estimated Cost Changes:

Table E-16. Alternative 5: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1	$207,337
Change in Costs under Alternative 5 due to Bonding @5 Total Change in Costs under Alternative 1	1,360 1,360
Total Project Costs under Alternative 3	$208,697
Percent Change in Costs from Alternative 1 to Alternative 3	<1%

Small Placer Mine

The small placer mine project would be conducted by a small miner with used or borrowed equipment. The model assumes that the operation would disturb ½ mile of a stream. Both the stream channel and the uplands would be mined, and no mercury would be used. Most of these types of operators are people who either work part time at the job or do not pay themselves a salary before calculating profits. The money they make is based on profits from their operations.

Project size:	An estimated 3 acres of disturbance
Production rates:	250 loose cubic yards/year
Mine life:	5 years
Average grade:	$4.00/bank cubic yards @ $300.00/oz
Overburden:	<7 feet
Pay gravel:	< 4 feet
Strip ratio:	1 to 1.75
Equipment use:	Dozer (D6), loader (930), mobile wash plant (hopper, vibrating screens, trommel /sluice box, and concentrating table at 45 cubic yards per day) at 780 gallons per minute of water usage.
Crew:	Two workers
Camp:	On-site small trailers and temporary sheds
Fuel storage:	500 gallon above-ground tank
Permitting:	Notice-level, 15 days to complete; no federal/state joint coordination needed. Note that this operation could require a Plan of Operations if on special category lands.
Reclamation:	Recontouring and revegetation, stream restoration, concurrent with mining.

Permitting and Environmental Costs: Under this operation, the prospector or miner would submit to BLM. the Notice, which would range in size and technical sophistication. Permitting and environmental costs are difficult to determine by a generalized method. The costs of permit authorization and environmental documentation vary greatly because of site-specific conditions. Depending on the ore body sought, its location, and other local environmental conditions, the cost can cover a broad range.

The Notice is usually hand written, includes a map, and would take an estimated 8 hours to compile and provide information to BLM. The estimated cost would be $220, based on $28/hr.

Operation Costs: All the equipment is either owned or borrowed, and no capital expenses are incurred. This model includes no depreciation or other ownership expenses.

On the basis of normal operations, small placer mines would operate for 60, 8-hour days for 480 hours/year of labor. This time is based on the seasonal restriction to placer operations and the small size of the operation.

Labor costs	
2 laborers at $28/hr for 5 years	$134,400
Operating Cost	
Equipment	
fuel	$6,720/yr for 5 years
Maintenance	$13, 861/yr for 5 years
Supplies	$10,000/yr for 5 years
Total	$152,905

Reclamation Costs: Placer mining is a form of strip mining that usually operates within stream channels. The area would be recontoured concurrently with the production of gravels. The overall size of the operation would be 12 acres, but at the end of the operation only 6 acres should be reclaimed. The operation would require more reclamation for repairing any stream channels and restoring habitat. The mine would include sediment ponds and other sediment and control structures.

Stream Restoration - There are few references for the costs of stream restoration. This model used published data from EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991). The figures listed in this document are assumed to cover regrading and stream recontouring, topsoil placement, revegetation, and wildlife work. Topsoil is required only on the floodplain and would not be spread in the channel. Seeds would be broadcast by hand. Stream restoration would include establishing vegetation, reconstruction, and building habitat structures. The channel dimensions would be 2 feet deep by 8 feet wide by 1 mile long at a 3% slope.

The documentation for reclamation shows several costs, depending on the type of work completed. Table 12 of EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows the cost of stream and floodplain reconstruction to be $7 to $17/foot. This model assumes $10/ft for wildlife and fish restoration.

Chemical Stabilization - The mine would use no chemicals that involve closure issues. Sediments would be reclaimed during recontouring.

Structure Removal - Structure removal would consist mainly of removing process buildings, office trailers, maintenance shops, and high-density polyethylene (HDPE) pipelines used by the project. The model assumes that three workers would take 5 days to remove the facilities. The complete operation is portable and can be easily transported.

Table E-17. Placer Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting Plan Preparation	Miner working for eight hours		$220
Permitting Total			$220
Placer Mining Activity:			
Capital Cost			
Operating Cost - Labor			134,400
Operating Cost -			152,905
Exploration Activity Total			$287,305
Reclamation:			
Stream Restoration	Based on EPA Reference	10/foot	26,500
Structural removal			
Equipment	2.5 Ton Truck for 10 Days	60/day	300
	1 Tracked Excavator (Cat 231d) -10 Hrs	100/hr	1000
Mob/Demob	2 Vehicle	500	1000
Labor	2 Person Crew for 5 Days at 10 Hours/day	27/hr	2,800
Reclamation Total			31,600
Total Cost of Placer Project			$319,320

Alternative 1: No Action

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: Determining costs for this alternative for all of the states involved in mining would not be practical for this exercise. Therefore, the following cost calculations assume that the state program is closely based on current State of Nevada regulations, with a few differences. A review of the state programs reveals that they are similar in posting bonds for reclamation and in surface water, ground water, and reclamation requirements.

Permitting and Environmental Costs:

Notice Preparation - The operator would have to submit something comparable to a Notice to the state but not to BLM. The operator would still produce a Notice, but the Notice would not be subject to environmental review, and the operator would not have to pay for an environmental assessment.

Reclamation Costs:

Stream Restoration - This analysis assumes that the state would require reclamation. The company would have to reclaim any disturbance resulting from its operation, but reclamation would not require restoring wildlife and fisheries habitat.

The documentation for restoration shows several costs, depending on the type of work completed. Table 12 in EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows stream and floodplain reconstruction to be $7 to 17/foot. Assuming that wildlife and fisheries habitat would not be restored, the cost would be $7/foot.

Total Estimated Cost Changes: Total cost savings for this placer project under Alternative 2 are summarized in Table E-18.

Table E-18. Alternative 2 -- Changes in Costs for Placer Project	
Total Project Cost under Alternative 1 (Existing Regulations)	$319,320
Change in Costs under Alternative 2 Due to	
Change in Stream Restoration Cost	(7,920)
Total Change in Costs under Alternative 2	(7,920)
Total Project Cost under Alternative 2 (State Management)	$311,400
Percent Change in Costs from Alternative 1 to Alternative 2	-3 %

Alternative 3: Proposed Action

General: Under the Proposed Action all mining operations would be required to submit a Plan of Operations. Bonding and a potential validity exam would add cost to the placer mine model. Other reclamation costs would be needed to complete the requirements of higher wildlife and wetland standards.

The performance standards are basically being followed at this time. For this model the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no added cost of erosion control blankets would be needed above erosion and sediment control structures.

Permitting and Environmental Costs: Permitting and environmental costs are hard to determine in a generalized way. The costs of permit authorizations and environmental documentation greatly vary with site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a board range. For the following costs several mining companies and consultant firms were contacted. These costs are averaged and are shown in Table E-19.

Plans of Operations - The operation would require a Plan of Operations. Under the Proposed Action all mining would be required to submit a Plan of Operations. The operator would pay for the environmental analysis, which would include a wetlands study, steam restoration/reclamation plan, cultural survey, and a wildlife/fisheries field study.

Bonding - The Proposed Action would strengthen bonding to include the bonding of Plans at 100% of reclamation cost. Bonding would be used to reclaim sites if operators could not complete their reclamation obligations. The bond amount would change to cover the estimated cost to reclaim the operation. This model assumes that the operator is buying an annuity bond, paying insurance premiums that would cost 5% of the bond amount.

Validity Exams - The Proposed Action would require BLM to conduct a validity exam before approving a Plan of Operations for an area withdrawn from the mining laws. These costs would remain the same as outlined for exploration under the Proposed Action. This analysis assumes that BLM will require cost recovery.

Reclamation Cost:

Stream Restoration - Table 12 of the EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows stream and floodplain reconstruction costs to range from $7 to 17/foot. For the Proposed Action the analysis assumes $17/ft for meeting the wildlife and fish restoration standards, costing the operator in an additional $36,900.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-19.

Table E-19. Alternative 3 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1	$319,320
Change in Costs under Alternative 3 due to Plan of Operation	2,500
Change in Costs under Alternative 3 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 3 due to Bonding	
5% for 10 yrs	$7,900
Change in Costs under Alternative 3 due to Reclamation	18,380
Total Change in Costs under Alternative 3	108,780
Total Project Costs under Alternative 3	428,100
Percent Change in Costs from Alternative 1 to Alternative 3	34%
Change in Costs Assuming Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Validity Exam	10,000
Total Project Costs under Alternative 3	$438,100
Percent Change in Costs from Alternative 1 to Alternative 3	37%

Alternative 4: Maximum Protection

General: These type of standards and criteria under Alternative 4 would directly affect placer mining: bonding, inspection and enforcement, replacing topsoil, protecting fish and wildlife habitat and wetlands, and revegetation. The automatic stay for appeals under Alternative 4 would delay placer mining and result in the costs of lost time and the delay of potential future profits. Delays are addressed in the following discount cash flow analysis.

The soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but this model assumes that no additional costs would be needed for erosion control blankets above erosion and sediment control structures.

Permitting and Environmental Costs:

Bonding - Bonding would be as outlined for Alternative 3 but would include extra money for major environmental events. For placer projects other than petroleum spills, added costs would not need to be addressed for major environmental problems. Any petroleum spill would require removing the contaminated soils and trucking them to an approved disposal site for treatment. No other chemicals are expected to be used onsite.

For Alternative 4 the model assumes that the operator will build an oil treatment facility onsite to handle all spills from the operation. The model also assumes that the operator would purchase an annuity bond from an agency, paying an insurance premium that would cost an estimated 5% of the bond amount. This amount would be the same as under Alternative 3.

Inspections - Under Alternative 4 operators would have to hire third-party contractors quarterly to monitor their operations. The contractor would complete the inspection and prepare the report in a 10-hour day but would not take environmental samples. The contractor would conduct the monitoring program for the 10 years of the mine operation at an average salary of $50/hour.

Validity Exams - Alternative 4 would require BLM to conduct a validity exam before approving a Plan of Operations. This analysis assumes that these costs would be passed on to the operator.

Reclamation Costs:

Stream Restoration - Because of Alternative 4's set design standards, the restoration of riparian areas would be extensive. The handling of topsoil would require more time because of the loss in equipment efficiency. Revegetation would require the exclusive use of native species, and wetlands would have to be in properly functioning condition within 10 years. The model assumes that both the stream and the uplands would be disturbed. For riparian areas and wetlands to reach properly functioning condition and to meet wildlife and fishery habitat needs, more restoration would be required.

EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows that the cost of restoring a stream and upland areas can vary greatly. The cost of total stream and floodplain reconstruction with fisheries can cost from $28 to $47/foot. For Alternative 4 the model assumes that total stream and floodplain restoration would be needed and that restoration would cost $28/foot, an amount that includes restoring fisheries to meet the 10-year requirement for properly functioning condition for riparian lands and fisheries use.

Total Estimated Cost Changes: If the exploration operation is not within an area withdrawn from the mining laws, the project would incur the costs shown in Table E-20.

Table E-20. Alternative 4 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1:	$319,320
Change in Costs under Alternative 4 due to:	
Stream Restoration	47,420
Third-Party Monitoring	10,000
Change in Costs under Alternative 4	2,500
Change in Costs under Alternative 4 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Bond	1,580
Validity Exam	10,000
Total Change in Costs under Alternative 4	164,000
Total Project Costs under Alternative 4	$483,320
Percent Change in Costs from Alternative 1 to Alternative 4	51%

Alternative 5

General: Under Alternative 5 all mining operations would be required to submit a Plan of Operations and post a bond. The performance standards are basically being followed at this time. For this model the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no added cost of erosion control blankets would be needed above erosion and sediment control structures.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-21.

Table E-21. Alternative 5 -- Change in Costs for Placer Project

Total Project Cost under Alternative 1	$319,320
Change in Costs for Alt.5 due to Plan of Operation	2,500
Change in Costs under Alternative 5 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 5 due to Bonding @ 5% for 10 yrs	$7,900
Change in Costs under Alt.5 due to Reclamation	18,380
Total Change in Costs under Alternative 5	$108,780
Total Project Costs under Alternative 5	$428,100
Percent Change in Costs from Alternative 1 to Alternative 5	34%

Placer Model

The placer operation would be conducted by a medium-size mining company. The model assumes the operation is for precious metals, gold. The operation would disturb 1 mile of stream, including the stream channel and uplands. No mercury would be used onsite.

Resource size: 1,000,000 bank cubic yards
Production rate: 500 loose cubic yards per day
Mine life: 10+ years
Average grade: $4 per bank cubic yards @ $300/oz.
Overburden: < 14 feet
Pay gravel: <4 feet
Equipment used: Dozer (D8), Excavator (235), mobile washplant (hopper, vibrating screen, 4' x 30' single sluice, 1200 g.p.m. water use)
Crew: 3 workers
Camp: One-site small trailers and temporary sheds
Fuel storage: 1,000 gallons in portable tanks with spill containment, biotreatment facility onsite
Permitting: Environmental assessment completed, 2 months to complete, joint state coordination
Reclamation: Recontouring and revegetation, stream restoration, concurrent with mining

Note: This operation would require some recontouring of waste rock. The waste piles would be both in the old part of the pit and out of the pit at a 2:1 slope.

Permitting and Environmental Costs: Permitting and environmental costs are hard to determine in a generalized way. The costs of permit authorizations and environmental documentation greatly vary with site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a board range. For the following costs several mining companies and consultant firms were contacted. These costs are averaged and are shown in Table E-22.

Plans of Operations - The operation would be filed under a Plan of Operations. The operator would pay for the environmental analysis, which would include a wetlands study, steam restoration/reclamation plan, cultural survey, and a wildlife/fisheries field study.

Bonding - The model assumes that the operator is buying an annuity bond from an agency and paying an insurance premium that would cost an estimated 5% of the bond amount per year. The model further assumes that the operator has a good credit rating and has the assets to back the bond. The bond would be assessed at 5% for 10 years and would cost $3,225.00.

Reclamation Costs: Placer mining is a form or strip mining that usually operates within stream channels. The area would be recontoured concurrently with the production of the gravels. The overall size of the operation would be 12 acres, but at the end of the operation only 6 acres would be reclaimed. The operation would require more reclamation for repairing any stream channels and restoring habitat. The mine would include sediment ponds and other sediment and control structures.

Stream Restoration - There are few references for the costs of stream restoration. This model used published data from EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991). The figures in this document are assumed to cover regrading and stream recontouring, topsoil placement, revegetation, and wildlife work. Topsoil is required only on the floodplain and would not be spread in the channel. Seeds would be broadcast by hand. Stream restoration would include establishing vegetation, reconstruction, and building structures for habitat. The channel dimensions would be 2 feet deep by 8 feet wide by 1 mile long at a 3% slope.

The documentation for reclamation shows several costs, depending on the type of work completed. Table 12 of EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows the cost of stream and floodplain reconstruction to be $7 to $17/foot. This model assumes $10/ft for wildlife and fish restoration.

Chemical Stabilization - The mine would use no chemicals that involve closure issues. Sediments would be reclaimed during recontouring.

Structure Removal - Structure removal would consist mainly of removing process buildings, office trailers, maintenance shops, and high-density polyethylene (HDPE) pipelines used by the project. The model assumes that three workers would take 10 days to remove the facilities. The complete operation is portable and can be easily transported.

Table E-22. Placer Model Costs			
Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting			
Plan Preparation	Two People 5 Days with Computer Support		$2,500
EA preparation			80,000
	Includes Wetlands study	5,000	
	Restoration/reclamation plan	5,000	
	Wildlife/fisheries studies	10,000	
	Cultural survey	10,000	
	Bond Cost	5% for 10 yrs	32,250
Permitting Total			114,750
Placer Mining Activity:			
Capital Cost			250,000
Operating Cost - Labor			425,000
Operating Cost - Equipment			300,000
Exploration Activity Total			$975,000
Reclamation:			
Stream Restoration	Based on EPA Reference	10/foot	52,800
Structural removal			
Equipment	2.5 Ton Truck for 10 Days	60/day	600
	1 Tracked Excavator (Cat 231d) -20 Hrs	100/hr	2000
Mob/Demob	2 Vehicle	500	1000
Labor	3 Person Crew for 10 Days at 10 Hours/day	27/hr	8,100
Reclamation Total			64,500
Total Cost of Placer Project			$1,154,250

Alternative 1: No Action

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: Alternative 2 is based on the states taking over the surface management of mining on public lands. Determining costs for this alternative for all of the states involved in mining would not be practical for this exercise. Therefore, the following cost calculations would be based on the assumptions that the state program would based on current BLM regulations. A review of the state programs reveals that they are similar in posting bonds for reclamation and in surface water, ground water, and reclamation requirements.

This analysis assumes that the state would require a Plan of Operations, reclamation, the posting of bond, and monitoring for compliance, but no environmental review for such aspects of the project as cultural resources, cave resources, and wildlife.

Permitting and Environmental Costs:

Plan of Operations Preparation - The operator would have to submit a Plan to the state but not to BLM. The operator would still produce a Plan of Operations, but the Plan would not be subject to environmental review, and the operator would not have to pay for an environmental assessment.

Reclamation Costs:

Stream Restoration - This analysis assumes that the state would require reclamation. The company would have to reclaim any disturbance resulting from their operation, but reclamation would not require restoring wildlife and fisheries habitat.

The documentation for restoration shows several costs, depending on the type of work completed. Table 12 in EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows stream and floodplain reconstruction to be $7 to 17/foot. Assuming that wildlife and fisheries habitat would not be restored, the cost would be $7/foot.

Total Estimated Cost Changes: Total cost savings for this placer project under Alternative 2 are summarized in Table E-23.

Table E-23. Alternative 2 -- Changes in Costs for Placer Project	
Total Project Cost under Alternative 1 (Existing Regulations)	$1,154,250
Change in Costs under Alternative 2 Due to	
Elimination of Environmental Review	(80,000)
Change in Stream Restoration Cost	(15,840)
Total Change in Costs under Alternative 2	(95,840)
Total Project Cost under Alternative 2 (State Management)	$1,058,410
Percent Change in Costs from Alternative 1 to Alternative 2	- 1%

Alternative 3: Proposed Action

General: Direct cost increases to the operator would be minimal because BLM and industry are generally following these procedures in authorizing operations and accepting final closure and reclamation.

Under the Proposed Action the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no additional cost of erosion control blankets would be needed above erosion and sediment control structures.

Under the Proposed Action, bonding and a potential validity exam would add cost to the Placer Mine model. Other reclamation costs would be needed to complete the requirements of higher wildlife and wetland standards.

Permitting and Environmental Cost:

Validity Exams - The Proposed Action would require BLM to conduct a validity exam before approving a Plan of Operations for an area withdrawn from the mining laws. These costs would remain the same as outlined for exploration under the Proposed Action.

Reclamation Cost:

Stream Restoration - Table 12 of the EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows stream and floodplain reconstruction costs to range from $7 to 17/foot. For the Proposed Action the analysis assumes $17/ft for meeting the wildlife and fish restoration standards. Meeting these standards would result in an additional cost to the operator of $36,900.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-24.

Table E-24. Alternative 3 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1	$1,154,250
Change in Costs under Alternative 3 due to Reclamation Total Change in Costs under Alternative 3	36,900 36,900
Total Project Costs under Alternative 3	1,191,150
Percent Change in Costs from Alternative 1 to Alternative 3	7%
Change in Costs Assuming Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Validity Exam	10,000
Total Project Costs under Alternative 3	$1,201,150
Percent Change in Costs from Alternative 1 to Alternative 3	8%

Alternative 4: Maximum Protection

General: These type of standards and criteria under Alternative 4 would affect placer mining. Bonding, inspection and enforcement, replacing topsoil, protecting fish and wildlife habitat and wetlands, and revegetation would directly affect placer mining.

The automatic stay for appeals under Alternative 4 would delay placer mining and result in the costs of lost time and the delay of potential future profits. The cost of delays are addressed in the following discount cash flow analysis.

The soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but this model assumes that no added costs would be needed for erosion control blankets above erosion and sediment control structures.

Permitting and Environmental Costs:

Bonding - Bonding would be as outlined for Alternative 3 but would include extra money for major environmental events. For placer projects other than petroleum spills, added costs would not need to be addressed for major environmental problems. Any petroleum spill would require removing the contaminated soils and trucking them to an approved disposal site for treatment. No other chemicals are expected to be used onsite.
For Alternative 4 the model assumes that the operator will build an oil treatment facility onsite to handle all spills from the operation. The model also assumes that the operator will purchase an annuity bond from an agency, paying an insurance premium that would cost an estimated 5% of the bond amount. This amount would be the same as under Alternative 3.

Inspections - Under Alternative 4 operators would have to hire third-party contractors quarterly to monitor their operations. The contractor would complete the inspection and prepare the report in a 10-hour day but would not take environmental samples. The contractor would conduct the monitoring program for the 10 years of the mine operation at an average salary of $50/hour.

Validity Exams - Alternative 4 would require BLM to conduct a validity exam before approving a Plan of Operations.

Reclamation Costs:

Stream Restoration - Because of Alternative 4's needs to set design standards, the restoration of riparian areas would be extensive. The handling of topsoil would require more time because of the loss in equipment efficiency. Revegetation would require use of native species, and the wetlands would have to be in properly functioning condition within 10 years. The model assumes that both the stream and the uplands would be disturbed. For riparian areas and wetlands to reach properly functioning condition and to meet wildlife and fishery habitat needs, more restoration would be required.

EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows that the cost of restoring a stream and upland areas can vary greatly. The cost of total stream and floodplain reconstruction with fisheries can cost from $28 to $47/foot. For Alternative 4 the model assumes that total stream and floodplain restoration would be needed and that restoration would cost $28/foot, an amount that includes restoring fisheries to meet the 10-year requirement for properly functioning condition for riparian lands and fisheries use.

Total Estimated Cost Changes: If the exploration operation is not within an area withdrawn from the mining laws, the project would incur the costs shown in Table E-25.

Table E-25. Alternative 4 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1:	$1,154,250
Change in Costs under Alternative 4 due to:	
Stream Restoration	$110,880
Third-Party Monitoring	$20,000
Bond	$10,000
Validity Exam	$10,000
Total Change in Costs under Alternative 4	$150,880
Total Project Costs under Alternative 4	$1,305,130
Percent Change in Costs from Alternative 1 to Alternative 4	+ 13%

Alternative 5

General: Cost increases to the operator would be minimal because BLM and industry are generally following these procedures in authorizing operations and accepting final closure and reclamation. Under Alternative 5, bonding would add cost to the placer mine model. Other reclamation costs would be needed to complete the requirements of higher wildlife and wetland standards. The cost would be the same as outlined for Alternative 3.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-26.

Table E-26. Alternative 5 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1	$1,154,250
Change in Costs under Alternative 5 due to Reclamation	$36,900
Total Project Costs under Alternative 5	$1,191,150
Percent Change in Costs from Alternative 1 to Alternative 5	7%

Strip Mining/ Industrial Mineral Model

This strip mine is being operated by a medium-sized industrial mineral organization. This mine is the organization's main source and directly supplies an operating mill and production facility. This model is organized after a gypsum operation.

Resource size:	1 million tons
Production rate:	250 tons per day
Mine life:	10+ years
Overburden:	4 feet, no waste rock expected
Pay layer:	4 feet
Equipment used:	Dozer (D8), excavator (235), front-end loaders, rear dump trucks, road graders, percussion drill, stationary washplant (hopper, vibrating screen, concentration/flotation mill, 1200 gpm water use)
Crew:	15 workers
Housing:	Nearby towns
Fuel:	5,000 gallons in portable tanks
Permitting:	Environmental assessment completed, 3 months to complete, joint state-federal coordination
Reclamation:	Recontouring and revegetation concurrent with mining

Note: This model assumes an industrial mineral, little overburden that is not reclaimed in the strip mining process, and a petroleum biotreatment facility onsite for cleaning up petroleum spills. A construction waste landfill is also onsite.

Permitting and Environmental Cost: Permitting and environmental costs are hard to determine by a generalized method. The cost of permit authorizations and environmental documentation greatly vary by site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a broad range. The following costs were derived from information obtained from several mining companies and consultant firms. These costs were averaged and are described below.

Plans of Operations - The operation would file a Plan of Operations. The operator would pay for the environmental analysis, which would include a wetlands study, steam restoration/ reclamation plan, cultural survey, and a wildlife/fisheries field study.

Bonding - The bonding of the operation would be at the maximum of $2,000/ac. This model assumes that the operator is purchasing an annuity bond and paying an annual insurance premium of 5% per year for 10 years. The model further assumes that the operator has a good credit rating and has the assets to back up the bond. The bond amount for this project is $65,000.

Reclamation Cost:

Earthwork - The model assumes that strip mining methods are used to extract most industrial minerals even though strip mining is only one of several ways industrial minerals are mined. The basic model is for bentonite- and gypsum-type deposits. No chemicals would be used to process the material, and the material's final processing is off site. The earthwork would consist of recontouring and covering with topsoil the roads, ancillary facilities, and the last strip pit. Strip mining applies ongoing concurrent reclamation, with each mined strip being refilled with the waste rock from the next pit and covered with topsoil. The calculations, therefore, address only the final phase of earth work and revegetation for the operation.

Cost of regrading.

Production rate	
Equipment	D9N. and U Blade
Average dozing distance	270 ft
Production	300 yd^3/hr
Correction factors	
Operator average	0.75
Material - loose stockpile/.ripped or blasted	1.20 or .08
Type dozing - slot to side by side	1.20
Job efficiency	0.83
Weight correction	0.83
Hourly Production rate	223 yd^3/hr
Cost Rates	
Bulldozing (D9N)	$155/hr
Operator	$40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Cubic Yards	Hours	Equipment Cost	Labor Cost
Waste Rock	10	1,200	54	$18,390	$2,160
Roads*	40	10,000	448	$69,440	$17,920
Ancillary Facilities	15	15,000	67	$19,385	$2,680
Cost of Recontouring				$107,215	$22,760

*Assumption that ripping production is the same as blading work.

Cost of applying top soil. Apply growth medium to an average thickness of 6 inches, using a scraper.

Production rate	
Equipment	615 Scraper
Capacity	16 yd^3

Average haul distance	1000 ft
Cycle time	
Cycles per hour	13.33 cycles/minute
Correction factors	
Load factor	0.9
Job efficiency	0.83
Eff. Load capacity	14.4 yd^3
Hourly production	159.4 yd^3/hr
Cost Rates	
615 scraper	$100/hr
Operator	$ 40/hr

From the above data, the following table estimates equipment and labor costs for applying topsoil.

	Acres	Cubic yards	Hours	Equipment cost	Labor cost
Waste Rock	10	24,200	152	$15,200	$6,080
Roads	40	96,800	608	60,800	24,320
Ancillary Facilities	15	36,300	228	22,800	9,620
Cost of applying topsoil				$98,800	40,020

Revegetation - Revegetation would require scarifying and preparing the ground for seeding. Seeds would be planted with drill seeding equipment. Aspects of wildlife habitat enhancement and wetland reclamation would be included in revegetation.

Production rates	
Equipment	14-G grader with scarifier
Scarifying width	10 feet
Operating speed	1.0 mph
Production rate	1.0 hr/ac
Equipment	Small tractor and seed drill
Seeding width	10 feet
Operating speed	2.5 mph
Production rate	0.33 hr/ac
Travel length	4356 ft/ac
Cost rates	
Tractor and seed drill	$50/hr
14-G Grader	$80/hr
Operator - grader	$40/hr
Labor (2)	$27/ac

Seed Mixture

Species	$/lb (PLS)	Drilled rate (lbs.)	Price/ac
Slender Wheatgrass	$1.25/lb	3	$3.75
Western Wheatgrass	$3.00/lb	2	$6.00
Fourwing Saltbrush	$8.00/lb	1	$8.00
Yellow Sweetclover	$0.60/lb	0.5	$0.30
Basin Wildrye	$5.60/lb	1	$5.60
Shadscale	$6.50/lb	2	$13.00
Small Burnett	$0.90/lb	2	$1.80
Thickspike Wheatgrass	$8.25/lb	0.5	$4.15
Prostrate Kochia	$17.50/lb	0.25	$4.40
Sainfoin	$1.40/lb	2	$2.80
Sandberg Bluegrass	$26.00/lb	0.25	$13.00/ac
		Total	$56.30/ac

Using the above data, the following table estimates equipment and labor costs for revegetation.

	Acres	Hours	Equipment Cost ($)	Labor Cost ($)
Waste Rock	10	10 hrs grader 3 hrs drill	800 150 563	400 162
Roads	40	40 hrs 13 hrs	3,200 650 2,252	1,600 202
Ancillary Facilities	15	15 hrs 5 hrs	1,200 250 844	600 270
Revegetation Cost			9,909	3,234

Removal of Structures - Structure removal would consist mainly of removing process buildings, office trailers, maintenance shops, and high-density polyethylene pipelines used by the project. The model assumes that five workers would take 30 days to remove the facilities and bury the foundations.

Table E-27. Industrial Mineral Mine Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting			
Plan Preparation	Two people five days, w/ computer support		$2,500
EA Preparation			$80,000
	Includes: Wetlands study	$5,000	
	Restoration and reclamation	$5,000	
	Wildlife/fisheries studies	$10,000	
	Cultural survey	$10,000	
Bond Cost	Estimated bond $24,000	5% for 10 yrs	$65,000
Permitting Total			$147,500
Open Pit Operation:			
Capital Cost			$400,000
Operating Cost - Labor			$1,800,000
Operating Cost - Equipment			$240,000
Exploration Activity Total			$2,440,000
Reclamation:			
Earth Work			
Regrading			
Equipment*:	D9N Dozer	$155/hr	$107,000
Labor*:	operator	$40/hr	$22,760
Applying top soil			
Equipment*:	615 Scraper	$100/hr	$98,800
Labor*:	operator	$40/hr	$40,080
Revegetation			
Equipment*	: 14-G Grader	$80/hr	
	Small Tractor and seed drill	$50/hr	$10,000
	Seed mixture	$56.30/ac	
Labor*:	Grader operator	$40/hr	
	2 laborers	$27/hr	$3,234
Total earth work and revegetation			*$282,000*
Structural removal	2.5 ton truck for 80 days	$60/day	
Equipment	Ho-lift equipment, 24ft boom-7.7mt lift	$165/day	
	D9N Dozer for 2 days	$155/hr	$7,370
Labor	5 person crew for 80 days at 8 hours/day	$27/hr	$32,400
Total Structural removal			*$39,770*
Reclamation Total			$321,800
Total Cost of Project			$2,909,300

*See estimated time to complete task in the information above.

Alternative 2: State Management

General: Determining the costs of the State Management Alternative for all of the states in the EIS study area would not be practical for this exercise. Therefore, the following cost calculations assume that the state program is based on current State of Nevada regulations. A review of the state programs reveals that they are similar in requirements for posting bond for reclamation, surface and ground water, and reclamation.

This analysis assumes that the state would require that a Plan of Operations be submitted. The state would still require reclamation, the posting of bond, and monitoring for compliance. The analysis further assumes that no environmental review of the project would be required for cultural resources, cave resources, or wildlife.

Permitting and Environmental Cost:

Plans of Operations - The operator would have to submit a Plan of Operations to the state but not to BLM. The project would not undergo environmental review, and the operator would not have to pay for an environmental assessment.

Reclamation Cost: Reflecting general state programs, reclamation is required for soil and slope stabilization only. Therefore, this analysis assumes that the state would require only grasses for soil stability and that wildlife and fisheries habitat would not have to be restored. The company would have to reclaim any disturbance caused by the operation.

The seed mixture under Alternative 2 would contain the following grasses:

Seed Mixture:

Species	$/lb (PLS)	Drilled rate	Price/ac
Slender Wheatgrass	$1.25/lb	3 lbs	$3.75/ac
Western Wheatgrass	$3.00/lb	2 lbs	$6.00/ac
Basin Wildrye	$5.60/lb	1 lb	$5.60/ac
Thickspike Wheatgrass	$8.25/lb	0.5 lb	$4.15/ac
Sandberg Bluegrass	$26.00/lb	0.25 lb	$13.00/ac
		Total	$32.50/ac

The following cost calculations show the cost for the seed mixture under Alternative 2.

Waste Rock	10 acres		$325.00
Roads	40 acres		$1,300.00
Ancillary Facilities	15 acres		$487.50
		Total	$2,112.50

Total Estimated Cost Changes: Total cost savings for this strip mine under Alternative 2 are summarized in Table E-28.

Table E-28. Alternative 2 -- Changes in Costs for a Industrial Mineral Mine Project

Total Project Cost under Alternative 1 (Existing regulations)	$2,909,300
Change in Costs under Alternative 2 due to Elimination of Environmental review	(80,000)
Change in Seed cost	(1,500)
Total Change in Costs under Alternative 2	(81,500)
Total Project Cost under Alternative 2 (State Management)	$2,827,800
Percent Change in Costs from Alternative 1 to Alternative 2	- 3%

Alternative 3: Proposed Action

General: Under the Proposed Action more costs could be required because of common variety determination. Impacts to the industry, however, would be minimal because BLM and industry are generally following these procedures in authorizing operations and reclamation. Any operation within a mineral withdrawal area would have the additional cost in time and money to complete a validity exam of the claims. These types of actions, however, would not occur often and for this model are assumed to involve no cost.

For this project the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no additional cost of erosion control blankets would be needed above erosion and sediment control structures.

Permitting and Environmental Cost:

Bonding - The bonding of the operation would become 100% of the reclamation costs. For this operation the cost of reclamation is $321,800. A bond at 5% for 10 years would cost $161,000.

Common Variety Determinations - Common variety determinations could be required for industrial mineral operations. This determination would verify that the mineral is locatable under the Mining Law or salable under the Mineral Materials Act of 1947.

Average cost = $30,000 per examination.

The cost to the operator is assumed to be $30,000 for preparation work for BLM. The analysis assumes that 10% of the exploration model and 50% for the strip mining activities would require this added cost.

Total Estimated Cost Changes: Estimated cost changes are summarized in Table E-29.

Table E-29. Alternative 3 -- Change in Costs for an Industrial Mineral Mine Project

Total Project Cost under Alternative 1	$2,909,300
Bond changes between Alternative 3 and 1.	$96,000
Total Project Cost under Alternative 3	$3,005,200
Percent Change in Costs from Alternative 1 to Alternative 3	3%
Change in Costs Assuming Validity Exam Is Conducted	
Change in Costs under Alternative 3 due to Validity Exam	$30,000
Total Project Costs	$3,035,200
Percent Change in Costs from Alternative 1 to Alternative 3	4%

Alternative 4: Maximum Protection

General: Under Alternative 4, bonding, inspection and enforcement, soil stability, topsoil, and revegetation would directly affect strip mining.
The waste rock design and road designs would be incorporated into the mine design and would not usually involve major costs. This model assumes that Alternative 4 would incur no more costs for road and slope stability design standards.

The acid rock drainage testing would be completed during the environmental review. The model assumes that the kinetic test would be included in the review. No other tests would be run unless acid generation potential changes from the rock types tested.

Permitting and Environmental Cost:

Bonding - Bonding would not change from that outlined for the Proposed Action except that more money would be added. for major environmental events Other than for petroleum spills, strip mines would not need to address added costs for major environmental problems. Any petroleum spill would require removing the contaminated soils and trucking them to an approved disposal site for treatment. No other chemicals are expected to be used onsite. This model assumes that the operator would build an oil treatment facility onsite and this site would handle all spills from the operation.

Inspections - Operators would be required to hire third-party contractors to monitor their operations. Monitoring the operation quarterly, the contractor could complete the inspection and prepare the report in a 10-hour day. No environmental samples would be collected.
Common Variety Determinations - For industrial minerals common variety determination and validity exams would be required to determine if the mineral is locatable under the Mining Law or salable under the Mineral Materials Act of 1947. Common variety determinations would be required under the reclamation and strip mining models. The average cost per examination is $30,000. An operation would have an unknown cost if a claim is in production and production is lost due to the claimant's assisting BLM in the exam. This model assumes that industry would

carry the cost to complete the project.

Reclamation Cost:

Earth Work - Under Alternative 4 the topsoil would be removed by soil horizons. The operation would remove the topsoil just as under other alternatives, but increased travel times to stockpile locations would decrease the efficiency of the earth moving equipment by not allowing blades to cut as deeply as possible. But the increased travel times would not be so great as to double the time needed to remove the topsoil.

Under the other alternatives, earth moving equipment would move the soil and colluvium in one or two passes, mixing the material together. The material would then be removed into different locations on either side of the road or drill pads. The travel distance would remain the same, but the efficiencies of the equipment would decrease. The efficiencies were estimated from the *Caterpillar Performance Handbook* (Caterpillar Inc. 1996) as 0.83. For Alternative 4 the efficiency would be estimated at 0.75. This time amounts to about 1 hour difference in the time needed to complete the dirt work.

Production rate		
	Equipment	615 Scraper
	Capacity	16 yd^3
	Average haul distance	1000 ft
Cycle time		
	Cycles per hour	13.33 cycles per minute
Correction factors		
	Load factor	0.9
	Job efficiency	0.75
	Eff. Load capacity	10.8 yd^3
	Hourly production	144 yd^3/hr
Cost Rates		
	615 scraper	$100/hr
	Operator	$ 40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Quantity	Hours	Equipment Cost	Labor Cost
Waste Rock	10	24,200	168	$16,800	$6,720
Roads	40	96,800	672	67,200	26,880
Ancillary Facilities	15	36,300	252	25,200	10,080
Cost of Applying Topsoil				109,200	43,680

Revegetation - Under Alternative 4 only native species could be used in revegetation. The open pit model outlines the seed mixture that would be used by this alternative. All other aspects of seeding the strip mine project would remain the same. Using the above data, the following table estimates equipment and labor costs for revegetation.

	Acres	Time	Equipment Cost	Labor Cost
Waste Rock	10	10 hrs grader 3 hrs drill total	$800 150 950	$400 162
Roads	40	40 hrs 13 hrs total	3,200 650 3,800	1,600 202
Ancillary Facilities	15	15 hrs 5 hrs total	1,200 250 1,425	600 270
Cost of Revegetation			12,425	$3,234

Soil Stability - To meet the stability standard for Alternative 4, more measures would need to be implemented. Any steep slopes could have some erosion control problems, but the added cost of erosion control blankets would be needed above standard erosion and sediment control structures. For analysis purposes, the project would need erosion control blankets on the waste rock piles (20 acres) and the roads (20 acres) for a total of 40 acres. Erosion control blankets cost \$0.45/yd^2, and the project would cost \$87,120.

Wetlands - Under Alternative 4 all wetlands must be restored within 10 years after final closure and reclamation of an operation. If this restoration is not possible, then 1.5 times the amount of the area disturbed or lost would need to be replaced. Reclamation is usually successful in restoring wetlands to proper functioning condition within 10 years. But open pit operations do remove wetlands in placing the pit and waste rock dumps. This model assumes that 10 acres of wetlands would be lost with the replacing of waste rock dumps.

Offsite mitigation is estimated to cost the same as stream restoration under Alternative 4 of the

495

placer mining model. For alternative 4 the model assumes $2,500/acre (INTER-FLUVE, Inc. 1991), which is needed to meet the 10-year requirement for properly functioning condition for wetlands. A stream restoration cost of $2,500/acre was used for this alternative. The project would reclaim 15 acres at a cost of $37,500.

Total Estimated Cost Changes: If the exploration operation is not in an area withdrawn for minerals, the project would incur the costs shown in Table E-30.

Table E-30. Alternative 4 – Change in Costs for an Industrial Mineral Mine Project	
Total Project Cost under Alternative 1:	$2,909,200
Change in Costs under Alternative 4 due to:	
Third-Party Monitoring; 40 hrs at $50/hr/year for 10 years	20,000
Applying Top Soil	152,880
Bonding	96,000
Re-vegetation Cost	2,516
Soil Stabilization	87,120
Validity Exam	30,000
Wetland Restoration	37,500
Total Change in Costs under Alternative 4:	426,000
Total Project Costs under Alternative 4:	$3,335,200
Percent Change in Costs from Alternative 1 to Alternative 4:	15%

Alternative 5

General: Under Alternative 5 more costs could be required because of common variety determination. Impacts to the industry, however, would be minimal because BLM and industry are generally following these procedures in authorizing operations and reclamation. Any operation within a mineral withdrawal area would have the additional cost in time and money to complete a validity exam of the claims. These types of actions, however, would not occur often and for this model are assumed to involve no cost. No validity exam would be required before the operation can begin.

Total Estimated Cost Changes: Estimated cost changes are summarized in Table E-31.

Table E-31. Alternative 5 – Change in Costs for an Industrial Mineral Mine Project	
Total Project Cost under Alternative 1	$2,909,300
Bond changes between Alternative 5 and 1.	$96,000
Total Project Cost under Alternative 5	$3,005,200
Percent Change in Costs from Alternative 1 to Alternative 5	3%

Small Underground Mine Operation

This underground operation disturbs less than 5 acres and processes ore in a small heap leach operation. This operation is standard for very small mining companies and individual miners. The operation is uses two 1,000-foot inclined shafts at a 45° angle

Resource size:	100,000 tons
Production rate:	30 tons per day
Mine life:	3 years mining and 2 years reclamation
Average grade:	0.55 oz. per ton @ $300/oz.
Stope dimensions:	100ft x 100ft x 50ft
Equipment used:	Single leg drill, LHD-3.5 cu. yd.,single compressor ventilation system one maintenance trucks, 2@25 KW generators, and two pickups for mining.
Fuel:	two 500 gallon above ground tanks with leak detection system.
Processing:	The operation uses conventual heap leach technology. Chemicals used for this process are on the site. A construction material dump is onsite, and a bio-remediation facility is onsite to process minor petroleum spills.
Crew:	5 workers
Housing:	Nearby towns
Permitting:	Joint federal/state coordination, cultural field studies
Reclamation:	Postmining recontouring and revegetation, stream restoration, water stabilization and recharge, chemical stabilization, wildlife reclamation projects

The development of an underground mine is extensive and costly. For this operation it is assumed that the operator is a small miner who owns or is borrowing most of the equipment to do the work. The operator does not receive a salary but gains any profits from mining the ore.

Permitting and Environmental Costs: Under this operation, the prospector or miner would submit a Notice to BLM. The document (Notice) will range in size and technical sophistication. Permitting and environmental costs are difficult to determine by a generalized method. The costs of permit authorization and environmental documentation vary greatly because of site-specific conditions. Depending on the ore body sought, its location, and other local environmental conditions, the cost can cover a broad range.

The Notice is usually hand written, includes a map, and would take an estimated 8 hours for 3 days to compile and provide information to BLM. The estimated cost would be $660 based on $28/hr.

Capital Cost: These capital costs are from *Mining Cost Service* (Western Mine Engineering, Inc. 1997b) for end slice mining method adit entry (800tons/day). The costs were proportionally reduced for this model's production (100tons/day) and reserves. The leaching cost were developed from Mine Cost Service from the Gold Heap Leaching paper, C1.

Mine Development Cost	
Adit	$99,375
Drift	$13,650
Cross Cut	$3,512
Ore pass	$4,170
Vent	$23,100

Leach Facility Cost	
Surface facilities site clean up 4.5 acres @ $3,000	$13,500
Leach Field	$28,237
Recovery	$1,000
Utilities	$9,000

Equipment: It is assume that the operator owns the load, dump, and haul (LHD); single leg drills; ventilation system; generators; utility vehicles; and any other startup equipment.

Total cost is $200,000.

Operation Cost:

Based on the Mining Cost Service's model (Western Mine Engineering, Inc. 1997b), supplies cost $4.97/ton. For this operation we used $1.00/ton, which is an estimated proportional cost for the mining and an estimated $1.00/ton for heap leach supplies. This would give us a total of $200,000 for supplies.

The equipment costs, except for the ventilation system, are based on 250 working days. The operator would not have a full crew, and employees would be switching jobs from one day to the next. Production would be maintained at an average of 100 tons/day.

LHD	$25.00/hr	$187,500.00
Drills	$0.40/hr	$3,600.00
Ventilation System	$0.60/hr	$5,400.00
Utility Vehicles	$6.62/hr	$1,700.00

Labor cost are variable, depending on whether the operator is paying wages or employees expect to get their wages from the operation's profits. For this model the operator is paying wages to six employees, all of which can do any of the jobs at the mine and leach facility. On average, the mine could produce 100 tons/day.

6 Miners	$28/hr @ 10hr/day @ 300days/yr @ 3 years
	$252,000

Reclamation Cost: This model assumes that the waste rock dump and the leach pad would be regraded with a D6 cat with a U blade.

Chemical Stabilization - Chemical stabilization would involve neutralizing the cyanide content of the heap leach pads and processing facilities. Operating costs would include any capital items such as pumps, piping, maintenance, and power. Costs for materials include the use of chemicals. The following figures were derived from submitted bond calculations and actual numbers from operations that have met closure. This reclamation involves heap flushing with water only. No other chemicals are added.

Cost of regrading and top soiling:

Production rate	
Equipment	D6N. and U Blade
Average dozing distance	270 ft
Production	300 yd^3/hr
Correction factors	
Operator average	0.75
Material - loose stockpile/.ripped or blasted	1.20 or .08
Type dozing - slot to side by side	1.20
Job efficiency	0.83
Weight correction	0.83
Hourly Production rate	223 yd^3/hr
Cost Rates	
Bulldozing (D9N)	$150/hr
Operator	$40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Cubic Yards	Hours	Equipment Cost	Labor Cost
Waste Rock	1	200	1	$150	$40
Ancillary Facilities	4	1,500	6	$900	$240
Cost of Recontouring				$1050	$280

Revegetation - Revegetation would require scarifying and preparing the ground for seeding. Seeds would be planted with drill seeding equipment. Aspects of wildlife habitat enhancement and wetland reclamation would be included in revegetation.

Production rates

Equipment	Small tractor and seed drill
Seeding width	10 feet
Operating speed	2.5 mph
Production rate	0.33 hr/ac
Travel length	4356 ft/ac

For 5 acres will require 2 hours to complete.

Cost rates

Tractor and seed drill	$50/hr @ 2	$100.00
Labor (2)	$27/hr @ 2	$108.00

Seed Mixture

Species	$/lb (PLS)	Drilled rate (lbs.)	Price/ac
Slender Wheatgrass	$1.25/lb	3	$3.75
Western Wheatgrass	$3.00/lb	2	$6.00
Fourwing Saltbrush	$8.00/lb	1	$8.00
Yellow Sweetclover	$0.60/lb	0.5	$0.30
Basin Wildrye	$5.60/lb	1	$5.60
Shadscale	$6.50/lb	2	$13.00
Small Burnett	$0.90/lb	2	$1.80
Thickspike Wheatgrass	$8.25/lb	0.5	$4.15
Prostrate Kochia	$17.50/lb	0.25	$4.40
Sainfoin	$1.40/lb	2	$2.80
Sandberg Bluegrass	$26.00/lb	0.25	$13.00/ac
		Total	$56.30/ac

Total seed needs 5 acres at $56.30/ac $281.50

Removal of structures - Structure removal would consist mainly of removing process buildings, office trailers, maintenance shops, and high-density polyethylene pipelines used by the project. The model assumes that five workers would take 30 days to remove the facilities and bury the foundations.

Total Estimated Cost Changes: Estimated cost changes are summarized in Table E-32.

Table E-32. Underground Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting			
Plan Preparation	[illegible] days at 8 hours	28/hr	$660.00
Permitting Total			$660.00
Underground Mining Activity:			
Capital Cost			
	Mine Development	$143,800	
	Leach Facility	$51,780	
	Equipment/ used and owned	$0	
			$195,500
Operating Cost			
	Labor	$252,000	
	Equipment	$198,000	
	Supplies	$200,000	
			$650,000
Underground Activity Total			
			$845,700

501

Reclamation:			
Earth Work			
Regrading			
Equipment	D6N Dozer	150/hr	$1,050
Labor:	operator	40/hr	$280
Revegetation			
Equipment			
	Small Tractor and seed drill	50/hr	$100
	Seed mixture	56.30/ac	$281.50
Labor:	2 laborers	27/hr	$108
Chemical Stabilization			
Estimated 100,000 tons,	Operating Cost	0.07/ton	$7,000
rinsing time 2 years	Materials Cost	0.05/ton	$5,000
	Labor: 2 people, 12 hours/day, 5 days/wks	27/hr	$6,400
Structural removal		60/day	$600
Equipment		165/day	$1,650
	2.5 ton truck for 10 days		
	Ho-lift equipment, 24ft boom-7.7mt lift		
Labor		27/hr	$6,480
	3 person crew for 10 days at 8 hours/day		
			$29,000
Total Cost of Underground Project			$875,400

Alternative 1: No Action

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: Alternative 2 is based on only the states' regulating mining on public lands. Determining costs for this alternative for all of the states involved in mining would not be practical for this exercise. Therefore, the following cost calculations would be based on the assumptions that the state program would be based on current State of Nevada program. A review of the state programs reveals that they are similar in posting bonds for reclamation and in surface water, ground water, and reclamation requirements. This analysis assumes that the state would require a Plan of Operations, reclamation, and monitoring for compliance.

Permitting and Environmental Costs:

Notice Preparation - The operator would have to submit a Notice-like document to the state but not to BLM. The operator would still prepare a Notice. There would be no cost saving to the operator under Alternative 2.

Reclamation Costs: It is assumed that the state would require reclamation of this type of operation and no cost savings would result.

502

Total Estimated Cost Changes: Total cost savings for this Underground project under Alternative 2 are summarized in Table E-33.

Table E-33. Alternative 2 -- Changes in Costs for Underground Project	
Total Project Cost under Alternative 1 (Existing Regulations)	$875,400
Total Change in Costs under Alternative 2	0
Total Project Cost under Alternative 2 (State Management)	$875,400
Percent Change in Costs from Alternative 1 to Alternative 2	0

Alternative 3: Proposed Action

General: Under the Proposed Action all mining operations would be required to submit Plans of Operations. Bonding and a potential validity exam would add cost to the underground mine model. The performance standards are basically being followed now. Therefore, in this model the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no additional cost of erosion control blankets would be needed above erosion and sediment control structures.

Permitting and Environmental Costs: Permitting and environmental costs are hard to determine in a generalized way. The costs of permit authorizations and environmental documentation greatly vary with site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a board range. For the following costs several mining companies and consultant firms were contacted. These costs are averaged and shown in Table E-34.

Plans of Operations - The operation would be filed under a Plan of Operations. Under Alternative 3 all mining must submit a Plan of Operations. The operator would pay for the environmental analysis, which would include a wetlands study, steam restoration/reclamation plan, cultural survey, and a wildlife/fisheries field study.

Bonding - The Proposed Action would strengthen bonding to include the bonding of Plans at 100% of reclamation cost. Bonding would be used to reclaim sites if operators could not complete their reclamation obligations. The bond amount would change to cover the estimated cost to reclaim the operation. This model assumes that the operator is buying an annuity bond and paying insurance premiums at an estimated 5% of the bond amount.

Validity Exams - The Proposed Action would require BLM to conduct a validity exam before approving a Plan of Operations for an area withdrawn from the mining laws. These costs would remain the same as outlined for exploration under the Proposed Action.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-34.

Table E-34. Alternative 3 -- Change in Costs for Underground Project	
Total Project Cost under Alternative 1	$875,400
Change in Costs under Alt.3 due to Plan of Operations	2,500
Change in Costs under Alternative 3 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 3 due to Bonding	
5% for 10 yrs	$7,900
Total Change in Costs under Alternative 3	$120,400
Total Project Costs under Alternative 3	995,800
Percent Change in Costs from Alternative 1 to Alternative 3	10%
Change in Costs Assuming Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Validity Exam	10,000
Total Project Costs under Alternative 3	$973,300
Percent Change in Costs from Alternative 1 to Alternative 3	11%

Alternative 4: Maximum Protection

General: These type of standards and criteria under Alternative 4 would affect underground mining. Bonding, inspection and enforcement, replacing topsoil, and revegetation would directly affect underground mining.

The automatic stay for appeals under Alternative 4 would delay underground mining and result in the costs of lost time and the delay of potential future profits. The cost of delays are addressed in the following discount cash flow analysis.

Permitting and Environmental Costs:

Bonding - For underground mines most spills that would involve more costs for major environmental problems would be cyanide or petroleum spills. For this model any petroleum spill would be removed with the contaminated soils and trucked to an approved disposal site for treatment. This model assumes that the operator would build an oil treatment facility onsite to handle all spills from this operation. Because estimating the cost of each type of spill scenario would be difficult, this analysis assumes that potential cyanide spills would add $50,000 more to the bond amount, placing the current estimated bond at $29,000.

The analysis again assumes that the operator is purchasing an annuity bond from an agency and would pay an insurance premium for the bond. This insurance would cost the operator 5% of the bond amount for 5 years through project operation and reclamation.

Inspections - Under Alternative 4 operators would have to hire third-party contractors to monitor their operations. Contractors would have to monitor operations quarterly and could complete inspections and prepare reports in a 10-hour day. Environmental samples would be taken during operations. These samples would be used for acid/base accounting to monitor the acid rock drainage potential and for the 31-element analysis of water quality areas throughout the mine. This model assumes costs from the Nevada Division of Environmental Protection's Profile II analysis. These samples would be collected only to verify operator results.

Labor		
40 hrs @ $50/hr/year for 5 years (Davis and Bacon)		$10,000
Lab work		
Acid/Base accounting	$33.08/sample @ 20 samples	$700
Profile II	$354.24/sample @ 20 samples	$7,000
	Total cost	$17,700

Validity Exams - Under Alternative 4 validity exams would need to be conducted before BLM approves Plans of Operations. These costs would remain the same as outlined for exploration under Alternative 3.

Reclamation Costs:

Topsoil - Under Alternative 4 the topsoil would be removed by soil horizons. Operations would remove the topsoil as under other alternatives, but increased travel time to stockpile sites would decrease the efficiency of the earth moving equipment by not allowing the blade to take as deep a cut as possible. But the increased travel times would not be so great as to double the time needed to remove topsoil.

Under the other alternatives earth moving equipment would mix the soil and colluvium together as it moves them in one or two passes. Under Alternative 4 the material would be removed to different locations on either side of the road or drill pads. The travel distance would remain the same, but the efficiencies of the equipment would decrease. Efficiencies were estimated from the *Caterpillar Performance Handbook* (Caterpillar Inc. 1996) as 0.83. For Alternative 4 the efficiency would be estimated at 0.75, about 1 hour more needed to complete the dirt work under the other alternatives. Under the main model the caterpillar would be able to place the topsoil on the heap leach pads and waste rock dumps. However for this fine of work a scraper would be required over and above the cost of the caterpillar work.

Production rate		
	Equipment	615 Scraper
	Capacity	16 yd^3
	Average haul distance	1000 ft
Cycle time		
	Cycles per hour	13.33 cycles/minute
Correction factors		
	Load factor	0.9
	Job efficiency	0.75
	Eff. Load capacity	10.8 yd^3
Hourly production		144 yd^3/hr
Cost Rates		
	615 scraper	$100/hr
	Operator	$ 40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Cubic Yards	Hours	Equipment Cost	Labor Cost
Waste Rock	1	200	1.4	$140.00	$56.00
Ancillary Facilities	4	1,500	10	$1,000.00	$400.00
Cost of Recontouring				$1,140.00	$456.00

Revegetation - Under Alternative 4 only native species would be used in revegetation. The underground model outlines the seed mixture that would be used. All other aspects of seeding the project would remain the same as under Alternative 1.

Seed Mixture (Mining Cost Service)

Species	Amount
Sanberg Bluegrass	20%
Indian Rice Grass	20%
Blue Grama	20%
Thickspike Wheatgrass	10%
Sand Dropseed	10%
Blue Flax	10%
Purple Coneflower	5%
Prairie Coneflower	5%
Scarlet Globemallow	5%
Utah Sweet Vetch	5%

Total seed needs 5 acres at ($9.50/lb @ 10lbs/ac) $95/ac $475

Soil Stability - To meet the stability standard for Alternative 4, other measures would need to be implemented. Any steep slopes could have some erosion control problems, but the added cost of erosion control blankets would be needed above standard erosion and sediment control structures. For analysis purposes, the following acreage would need erosion control blankets: waste rock 1 acres and leach pads 3 acres, for a total of 4 acres. Erosion control blankets cost $0.45/yd^2. For 4 acres @ 4,840 yd^2/acre, for a total of19,360 yd^2 to be covered, the total cost would amount to $8,700.

Wetlands - Alternative 4 would require that any wetlands would have to be restored within 10 years after a mine closes and is reclaimed. If this goal cannot be reached, then 1.5 times the amount of disturbed or lost land would need to be replaced. Reclamation is usually successful in restoring wetlands to proper functioning condition within 10 years. But open pit mines do remove wetlands in placing the pit or the waste rock dumps. This model assumes that 1 acre of wetlands would be lost to waste rock dumps.

The cost of offsite mitigation is estimated at the same cost as stream restoration under Alternative 4 of the placer mining model. For Alternative 4, the model assumes $2,500/acre (INTER-FLUVE, Inc. 1991), which is needed to meet the 10-year requirement for wetlands in properly functioning conditions. This analysis assumes stream restoration cost to be $2,500/acre for 1 acres for a total cost of $2,500.

Total Estimated Cost Changes: If the operation is not within a withdrawn area, the project would incur the costs shown in Table E-35.

Table E-35. Alternative 4 -- Change in Costs for an Underground Project	
Total Project Cost under Alternative 1:	$875,400
Change in Costs under Alternative 4 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 4 Due To:	
Bond Cost	19,700
Third Party Monitoring	17,700
Applying Top Soil	1,600
Revegetation Cost	190
Soil Stabilization	8,700
Validity Exam	10,000
Total Change in Costs under Alternative 4:	137,890
Total Project Costs under Alternative 4:	1,013,290
Percent Change in Costs from Alternative 1 to Alternative 4:	16%

Alternative 5

Same as Alternative 3 except no validity exam would be required before an operation could begin.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-36.

Table E-36. Alternative 5 -- Change in Costs for Underground Project	
Total Project Cost under Alternative 1	$875,400
Change in Costs under Alternative 5 due to Plan of Operations	
Change in Costs under Alternative 5 due to EA	$2,500
Includes Wetlands study	$80,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	5,000
Cultural survey	10,000
	10,000
Change in Costs under Alternative 5 due to Bonding 5% for 10 yrs	$7,900
Total Change in Costs under Alternative 5	$120,400
Total Project Costs under Alternative 5	995,800

Percent Change in Costs from Alternative 1 to Alternative 5	10%

Open Pit Model

The open pit model is for a medium-sized gold mine of a larger mining company.

Resource size:	7,000,000 tons
Production rate:	4,000 tons per day
mine life:	6 years mining and 4 years reclamation
Average grade:	0.053 oz. per ton @ $300/oz. Strip ratio: 2:1
Pit dimensions:	1000 ft x 900 ft x 130 ft deep
Equipment used:	Rotary drill (GD-25C), hydraulic crawler drill (HDR12E), air compressor, four loaders (988-B), four 50-ton rear-dump trucks (733), dozer (D-8) dozer (TD-25), grader, 4,000 gal water truck , two maintenance trucks, and two pickups
Fuel:	10,000 gallon portable tank gasoline, 50,000 gallon portable tanks for diesel and propane
Processing:	The operation uses conventual heap leach technology. Chemicals used for this process are on the site. A construction material dump is onsite, and a bioremediation facility is onsite to process minor petroleum spills.
Crew:	60 workers
Housing:	Nearby towns
Permitting:	EIS completed in 18 months, high public interest, baseline studies required to complete EIS, extensive joint federal/state coordination, cultural field studies
Reclamation:	Postmining recontouring and revegetation, stream restoration, water stabilization and recharge, chemical stabilization, wildlife reclamation projects

Note: Waste rock dumps were built to the grade standards outlined for each alternative, i.e. Alternative 3 states a 2:1 slope or a stable system, whereas Alternative 4 states a 3:1 slope. Roads would be built to meet standards for the alternative. The pit would have a small pit lake. Ground water would flow into the pit lake and evaporate. The pit lake would not overflow seasonally. Material at the site has been tested and shows no acid generation potential. The waste rock would have a 30% swell factor.

The model was derived from *Mining Cost Services* (Western Mine Engineering, Inc. 1997b), CM Appendix D4. The difference between the cost index for the original model development and the cost index for this model development was slight. Therefore, adjustments did not need to be made.

Permitting and Environmental Cost:

Plan of Operations - Permitting and environmental costs are hard to determine in a generalized way. The costs of permit authorizations and environmental documentation highly vary with site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a broad range. The operator would pay for the EIS, which would include hydrological and hydrogeology reports, acid rock drainage analysis, cultural surveys, soil and vegetation field surveys, fish and wildlife field surveys, Endangered Species Act Section 7 consultation, and pit water quality analysis. The costs developed for this model and alternatives were derived from several mining companies and consultant firms.

Bonding - The operation would require a Plan of Operations. The bond would be for 100% cost of the reclamation. Closing the heap leach pads and the rest of the mine would cost $2,000/acre. This model assumes that the operator is purchasing an annuity bond from an agency and would pay an insurance premium for the bond at an estimated 5% of the bond amount per year. The model further assumes that the operator has a good credit rating and has the assets to back the bond.

Reclamation Cost:

Earthwork - The earthwork would consist of recontouring the waste rock dump, leach pads, roads, and ancillary facilities and covering all these features with topsoil. The dump had been built to easily conform to the slope requirement. The amount of material moved and the amount of time needed to move the material is estimated below for analysis purposes.

Regrading:

Production rate		
	Equipment	D9N and U Blade
	Average Dozing distance	300 ft
	Final slope configurations	2.5H:10V(40%)
	Production	500 yd^3/hr
Correction factors		
	Operator average	0.75
	Material - loose stockpile	1.20
	Type dozing - slot to side by side	1.20
	Job efficiency	0.83
	Weight correction	0.83
Hourly Production rate		372 cu. yd./hr
Cost Rates		
	Bulldozing (D9N)	$155/hr
	Operator	$40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Quantity (yd³)	Time (hours)	Equipment Cost	Labor Cost
Waste Rock	120	2,800,000	7,526	$1,166,530	$301,040
Roads*	200	250,000	672	104,160	26,880
Ancillary Facilities	150	150,000	403	62,465	16,120
Leach Pads	125	200,000	536	83,080	21,440
Total Cost for Regrading				$1,416,235	$365,480

*Assumption that ripping production is the same as blading work.

Applying Top Soil:

The growth medium would be applied to an average thickness of 6 inches, using a scraper.

Production rate		
	Equipment	615 Scraper
	Capacity	16 yd³
	Average haul distance	1000 ft
Cycle time		
	Cycles per hour	13.33 cycles per minute
Correction factors		
	Load factor	0.9
	Job efficiency	0.83
	Eff. Load capacity	14.4 yd³
Hourly production		159.4 yd
Cost Rates		
	615 scraper	$100/hr
	Operator	$ 40/hr

Using the above data, the following table estimates equipment and labor costs for applying top soil.

	Acres	Quantity (yd³)	Hours	Equipment Cost	Labor Cost
Waste Rock	120	290,400	1,821	$182,100	$72,840
Roads	200	484,000	3,036	303,600	121,440
Ancillary Facilities	150	363,000	2,277	227,700	91,080
Leach Pads	125	302,500	1,897	189,700	75,880
Total Cost of Applying Top Soil				$903,100	$361,240

Revegetation - Revegetation would consist of scarifying and preparing the ground for seeding. Drill seeding would be applied. Aspects of wildlife enhancement and wetlands reclamation would be included in revegetation.

Production rates		
	Equipment	14-G Grader with scarifier
	Scarifying width	10 feet
	Operating speed	1.0 mph
	Production rate	1.0 hr/ac
	Equipment	Small tractor and seed drill
	Seeding width	10 feet
	Operating speed	2.5 mph
	Production rate	0.33hr/ac
	Travel length	4356.0 ft/ac
Cost rates		
	Tractor and seed drill	$50/hr
	14-G Grader	$80/hr
	Operator - grader	$40/hr
	Labor (2)	$27/ac

Seed Mixture

Species	$/lb (PLS)	Drilled rate	Price/ac
Slender Wheatgrass	$1.25/lb	3.0 lbs	$3.75/ac
Western Wheatgrass	$3.00/lb	2.0 lbs	$6.00/ac
Fourwing Saltbrush	$8.00/lb	1.0 lb	$8.00/ac
Yellow Sweetclover	$0.60/lb	0.5 lb	$0.30/ac
Basin Wildrye	$5.60/lb	1.0 lb	$5.60/ac
Shadscale	$6.50/lb	2.0 lbs	$13.00/ac
Small Burnett	$0.90/lb	2.0 lbs	$1.80/ac
Thickspike Wheatgrass	$8.25/lb	0.5 lb	$4.15/ac
Prostrate Kochia	$17.50/lb	0.25 lb	$4.40/ac
Sainfoin	$1.40/lb	2.0 lbs	$2.80/ac
Sandberg Bluegrass	$26.00/lb	0.25 lbs	$13.00/ac
		Total	$56.30/ac

Using the above data, the following table estimates equipment and labor costs for reseeding.

	Acres	Hours	Equipment Cost ($)	Labor Cost ($)
Waste Rock	120	120 (grader) 39 (drill)	$9,600 1,950 6,756	$ 4,800 2,106
Roads	200	200 66	16,000 3,300 11,260	8,000 3,564
Ancillary Facilities	150	150 50	12,000 2,500 8,445	6,000 2,700
Leach pads	125	125 41	10,000 2,050 7,038	5,000 2,214
Cost of Reseeding			$90,899	$34,384

Chemical Stabilization - Chemical stabilization would involve neutralizing the cyanide content of the heap leach pads and processing facilities. Operating costs include any capital items such as pumps, piping, maintenance, and power. Costs for materials include the use of chemicals. The following figures were derived from submitted bond calculations and actual numbers from operations that have met closure. This reclamation involves heap flushing with water only. No other chemicals are added.

Removal of Structures - Structure removal would consist mainly of removing powerlines, process buildings, office trailers, maintenance shops, and high-density polyethylene pipelines used by the project. The model assumes that five workers would take 80 days to remove the facilities and bury the foundations.

Total Open Pit Costs:

Table E-37 lists total costs for the open pit mining model.

Table E-37. Open Pit Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting Plan Preparation	Environmental and Engineering Departments Several Weeks		$10,000
EIS preparation			600,000
	Includes: Wetlands Study	$5,000	
	Water-Related Reports	$200,000	
	Restoration and Reclamation	$5,000	
	Wildlife/Fisheries Studies	$10,000	
	Vegetation/soil Report	$5,000	
	Cultural Survey	$20,000	
Bond Cost	Estimated Bond $2,891,842	5% for 10yrs	1,445,921
Permitting Total			2,055,921
Reclamation			
Capital Cost			14,000,000
Operating Cost - Labor			10,368,000
Operating Cost - Equipment			1,382,400
Exploration Activity Total			$25,750,400

Reclamation:			
Earth Work			
Regrading			
Equipment*:	D9N Dozer	155/hr	1,416,235
Labor*:	operator	40/hr	365,480
Applying top soil			
Equipment*:	615 Scraper	100/hr	903,100
Labor*:	operator	40/hr	361,240
Revegetation			
Equipment*	14-G Grader	80/hr	
	Small Tractor and seed drill	50/hr	90,899
	Seed mixture	56.30/ac	
Labor*:	Grader operator	40/hr	34,384
Total earth work and	2 laborers	27/hr	
revegetation			*3,171,338*
Chemical Stabilization			
Estimated 7,000,000 tons,	Operating Cost	0.07/ton	490,000
rinsing time 3 years	Materials Cost	0.05/ton	350,000
	Labor: 2 people, 12 hours/day, 5	27/hr	505,440
Total Chem. Stabilization	days/wks		*1,345,440*
Structural removal			
Equipment		60/day	
	2.5 ton truck for 80 days	165/day	
	Ho-lift equipment, 24ft boom-7.7mt lift	155/hr	20,480
	D9N Dozer for 2 days		
Labor		27/hr	8,100
Total Structural removal	5 person crew for 80 days at 8		*106,880*
Reclamation Total	hours/day		4,623,558
Total Cost of Open Pit Project			$32,429,879

*See estimated time to complete task in information above.

Alternative 1: No Action

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: Determining costs for Alternative 2 for all of the states in the EIS study area would not be practical for this exercise. Therefore, the following cost calculations assume that the state programs are based on current BLM regulations. A review of state programs reveals that they are similar in requirements for posting reclamation bonds, for surface and ground water, and for reclamation.

This analysis assumes that the state would require a submission of a Plan of Operations. The state would still require reclamation, the posting of bond, and monitoring for compliance, but not environmental review for such values as cultural, cave, and wildlife resources.

Permitting and Environmental Costs:

Plan of Operations - The operator would have to submit a Plan of Operations to the state but not to BLM. The project would not undergo environmental review, and the operator would not pay for an environmental impact statement.

Reclamation Cost: This analysis assumes that the state requires reclamation and that the company would have to reclaim any disturbance resulting from its operation. Reflecting general state programs, the purpose of reclamation would be only to stabilize soil and slopes. Therefore, this analysis assumes that the state would require only grasses for soil stability and that reclamation would not require restoring wildlife and fisheries habitat.

Seed Mixture

Species	$/lb (PLS)	Drilled rate	Price/ac
Slender Wheatgrass	$1.25/lb	3 lbs	$3.75/ac
Western Wheatgrass	$3.00/lb	2 lbs	$6.00/ac
Basin Wildrye	$5.60/lb	1 lb	$5.60/ac
Thickspike Wheatgrass	$8.25/lb	0.5 lb	$4.15/ac
Sandberg Bluegrass	$26.00/lb	0.25	$13.00/ac
		Total	$32.50/ac

The following cost calculations show the cost for the seed mixture under Alternative 2.

Waste Rock	120 acres	$3,900.00
Roads	200 acres	$6,500.00
Ancillary Facilities	150 acres	$4,875.00
Leach pads	125 acres	$4,062.50
	Total	$19,337.50

Total Estimated Cost Changes: Total cost savings for this open pit project under Alternative 2 are summarized in Table E-38.

Table E-38. Alternative 2 -- Changes in Costs for a Open Pit Project	
Total Project Cost under Alternative 1 (Existing Regulations)	$32,429,879
Change in Costs under Alternative 2 due to	
Elimination of Environmental Review	(600,000)
Change in Seed Cost	(14,161)
Total Change in Costs under Alternative 2	(614,161)
Total Project Cost under Alternative 2 (State Management)	31,815,718
Percent Change in Costs from Alternative 1 to Alternative 2	-2%

Alternative 3: Proposed Action

General: Impacts to the industry under the Proposed Action would be slight because BLM and industry are generally following these procedures in authorizing operations and accepting final closure and reclamation.Under the Proposed Action any operation within a mineral withdrawal area would have the addedl cost in time and money of completing a validity exam of the claims. The added cost to industry would involve stabilizing the soil. Land use plans are assumed to conform to mineral activity.

Reclamation would not approach the soil stability design limit. Any steep slopes could have some erosion problems, but this model assumes that no additional cost of erosion control blankets would be incurred above erosion and sediment control structures.

The operation would have a small pit lake. This model assumes that ground water flows into the pit and that for environmental and economic reasons 25% of the pit would be backfilled and the pit lake would be covered. To offset the loss of habitat from the open pit, a 200-acre vegetation conversion would be completed with water developments.

Permitting and Environmental Costs:

Bonding - The Proposed Action would strengthen bonding to include bonding of Notice-level operations at 100% of reclamation costs. Bonding would be used for reclaiming sites if operators could not meet their reclamation obligations.

This model assumes that the operator is purchasing an annuity bond and paying an insurance premium that would cost 2% of the bond amount, estimated at $4,623,558. The bond would be assessed on the estimated reclamation cost and for 10 years through mining and reclamation.

Validity Exams - This provision requires that a validity exam be conducted before BLM approves a Plan of Operations within an area withdrawn from the mining laws. These costs would remain the same as outlined for exploration under Alternative 3.

Reclamation Costs:

Backfilling - In placer and strip mines after processing, materials mined are normally placed in the mine opening at only minimal cost. Well-blasted rock, however, swells about 50% in volume, and not all material would be returned to the pit. The rest of the materials would have to be reshaped in place and reclaimed. For this operation the model assumes that only 25% of the material would need to be replaced into the pit. The pit would be only partially filled for economic or environmental reasons.

A study by BLM's Nevada State Office (BLM 1998d) on the economics of pit backfilling found that the cost of returning material to a pit ranged from $0.68 to $1/ton. This model uses the average of the figures as $0.75/ton.

The model assumes 7 millions tons of reserves and 14 million tons of overburden. Of this overburden only 25% or 3.5 million tons would be returned to the pit. The remaining waste rock would be placed in a waste rock dump built to conform to the 3:1 slope standard. The amount of material to be moved to complete the final contours would be 25% less than that moved under

517

Alternative 1. Therefore, 10.5 million tons of material would be placed in waste rock dumps. The current model shows that 2.8 million tons of material would have to be recontoured. With 25% of this material removed and placed in the pit, only 2.1 million tons of material would need to be moved to recontour the waste rock dumps. The hourly production rate is 372 yd^3/hr.

Cost Rates
Bulldozing (D9N) = $155/hr
Operator = $40/hr

Using the above data, the following table estimates equipment and labor costs for recontouring.

	Acres	Quantity (yd^3)	Time (hours)	Equipment Cost	Labor Cost
Waste Rock	120	2,100,000	5645	$874,975	$225,800
Roads*	200	250,000	672	104,160	26,880
Ancillary Facilities	150	150,000	403	62,465	16,120
Leach Pads	125	200,000	536	83,080	21,440
Total for Recontouring				$1,124,700	$290,200

*Assumption that ripping production is the same as blading work.

Total cost of recontouring work for Alternative 3 = $1,414,920

The cost under Alternative 1 would amount to $1,781,715, and the cost under Alternative 3 would be $1,414,920. Alternative 3 would thus save $366,795 over Alternative 1 by recontouring less material and returning more to the pit.

$2,625,000 for backfilling minus the cost saving of recontouring—$366,795

For a total cost of backfilling operation at 25% = $2,258,205.

Total Estimated Cost Changes: Estimated cost changes for an open pit mine are summarized in Table E-39.

Table E-39. Alternative 3 – Change in Costs for an Open Pit Project	
Total Project Cost under Alternative 1	$31,562,426
Change in Costs under Alternative 3 due to	
Bonding	364,700
Reclamation	2,258,200
Total Change in Costs under Alternative 3	
Total Project Costs under Alternative 3	34,185,326
Percent Change in Costs from Alternative 1 to Alternative 3	8%
Change in Costs Assuming Validity Exam is Conducted	
Change in Costs under Alternative 3 due to	
Bonding	364,700
Reclamation	2,258,200
Validity Exam	10,000
Total Project Costs under Alternative 3	34,195,326
Percent Change in Costs from Alternative 1 to Alternative 3	8%

Alternative 4: Maximum Protection

Alternative 4 would directly affect open pit mining through requirements for bonding, inspection, and enforcement, backfilling, stabilizing soil, handling topsoil, and revegetation. The need for validity exams, bonding criteria, and fish and wildlife habitat and wetland protection could also affect open pit operations. Waste rock and road designs would be incorporated into the mine design and would not normally have a major economic cost. This model assumes no additional cost for road and slope stability design standards under Alternative 4.

The acid rock drainage testing would be completed during the environmental review. This model assumes that a kinetic test would be included in the review. No other tests would be run unless the potential for acid generation changes from the rock types tested.

For ease of analysis, water from the mine is assumed not to require long-term treatment. The cost of the different types of water treatment vary greatly. If water is treated, it would be difficult to determine the duration of the treatment.

Permitting and Environmental Costs:

Bonding - Bonding under Alternative 4 would be as outlined for Alternative 3 but would include more money to cover potential unplanned environmental events, which could involve both processing chemicals and chemicals used in labs and for equipment maintenance (fuels and lubricants).

For open pit mines most spills that would involve more costs for major environmental problems would be petroleum and cyanide spills. For this model any petroleum spill would be removed with the contaminated soils and trucked to an approved disposal site for treatment. This model assumes that the operator would build an oil treatment facility onsite to handle all spills from this operation. Because estimating the cost of each type of spill scenario would be difficult, this analysis assumes for cyanide that $250,000 more would be assigned to the bond, placing the current estimated bond at $4,983,658.

The analysis again assumes that the operator is purchasing an annuity bond from an agency and would pay an insurance premium for the bond. This insurance would cost the operator 5% of the bond amount for 10 years through project operation and reclamation.

Inspections - Under Alternative 4 operators would have to hire third-party contractors to monitor their operations. Contractors would have to monitor operations quarterly and could complete inspections and prepare reports in a 10-hour day. Environmental samples would be taken during operations. These samples would be used for acid/base accounting to monitor the acid rock drainage potential and for the 31-element analysis of water quality areas throughout the mine. This model assumes costs from the Nevada Division of Environmental Protection's Profile II analysis. These samples would be collected only to verify operator results.

Labor		
40 hrs @ $50/hr/year for 10 years (Davis and Bacon)		$20,000
Lab work		
Acid/Base accounting	$33.08/sample @ 40 samples	$1,323
Profile II	$354.24/sample @ 40 samples	$14,170
	Total cost	$35,493

Validity Exams - Under Alternative 4 validity exams would need to be conducted before BLM approves Plans of Operations. These costs would remain the same as outlined for exploration under Alternative 3.

Reclamation Costs:

Backfilling - In placer and strip mines, materials mined are normally placed in the mine opening after processing, and only minimal cost is involved. Well-blasted rock would swell about 50% in volume. The material would not go back completely into the pit. The rest must be reshaped in place and reclaimed.

A BLM Nevada State Office (BLM 1998d) study on the economics of pit backfilling found that the cost of returning material to a pit ranged from $0.68 to $1/ton. This model uses the average of the figures as $0.75/ton. The model assumes 7 millions tons of reserves and 14 million tons of overburden and that 75% of the material would be required to fill up the pit and 25% of the material would be placed in a waste rock dump. A total of 10.5 million tons of material would be placed in the pit and would cost $7,875,000.

The remaining waste rock would be placed in a waste rock dump. The dump would be built to conform to the 3:1 slope standard. The amount of material to be moved to complete the final contours—175,000 tons—would be 25% less than what would be moved under the Alternative 1 scenario. This analysis assumes that only 50 acres are now covered in waste rock dumps.

Hourly Production rate = 372 yd^3/hr

Cost Rates

Bulldozing (D9N) = $155/hr
Operator = $40/hr

Using the above data, the following table estimates equipment and labor costs for backfilling.

	Acres	Quantity (yd^3)	Hours	Equipment Cost	Labor Cost
Waste Rock	50	175,000	470	$72,850	$18,800
Roads*	200	250,000	672	104,160	26,880
Ancillary Facilities	150	150,000	403	62,465	16,120
Leach Pads	125	200,000	536	83,080	21,440
Total Cost To Recontour				$322,600	$83,200

*Assumption that ripping production is the same as blading work.

The cost of recontouring under Alternative 1 would amount to $1,781,715, and the cost of recontouring under Alternative 4 would amount to $405,800. Alternative 4 would save $1,375,920 in recontouring costs because less material would be recontoured and more would be returned to the pit.

$7,875,000 for backfilling minus the cost saving of recontouring $1,375,920

For a total cost of backfilling operation $6,499,080.

Topsoil - Under Alternative 4 the topsoil would be removed by soil horizons. Operations would remove the topsoil as under other alternatives, but increased travel time to stockpile sites would decrease the efficiency of the earth moving equipment by not allowing the blade to take as deep a cut as possible. But the increased travel times would not be so great as to double the time needed to remove topsoil.

Under the other alternatives earth moving equipment would mix the soil and colluvium together as it moves them in one or two passes. Under Alternative 4 the material would be removed to different locations on either side of the road or drill pads. The travel distance would remain the same, but the efficiencies of the equipment would decrease. Efficiencies were estimated from the *Caterpillar Performance Handbook* (Caterpillar Inc. 1996) as 0.83. For Alternative 4 the efficiency would be estimated at 0.75, about 1 hour more needed to complete the dirt work under the other alternatives.

Production rate		
	Equipment	615 Scraper
	Capacity	16 yd^3
	Average haul distance	1000 ft
Cycle time		
	Cycles per hour	13.33 cycles per minute
Correction factors		
	Load factor	0.9
	Job efficiency	0.75
	Eff. Load capacity	10.8 yd^3
Hourly production		144 yd^3/hr
Cost Rates		
	615 scraper	$100/hr
	Operator	$ 40/hr

Using the above data, the following table estimates equipment and labor costs of earthwork.

	Acres	Quantity (yd^3)	Hours	Equipment Cost	Labor Cost
Waste Rock	50	90,750	630	$63,000	$25,200
Roads	200	484,000	3,361	336,100	134,440
Ancillary Facilities	150	363,000	2,520	252,000	100,800
Leach Pads	125	302,500	2,100	210,000	84,000
Total Cost for Earthwork				$861,100	$344,500

Revegetation - Under Alternative 4 only native species would be used in revegetation. The open pit model outlines the seed mixture that would be used. All other aspects of seeding the exploration project would remain the same as under Alternative 1.

Seed Mixture (Mining Cost Service)

Species	Amount
Sanberg Bluegrass	20%
Indian Rice Grass	20%
Blue Grama	20%
Thickspike Wheatgrass	10%
Sand Dropseed	10%
Blue Flax	10%
Purple Coneflower	5%
Prairie Coneflower	5%
Scarlet Globemallow	5%
Utah Sweet Vetch	5%
Total $9.50/lb @ 10lbs/ac	$95/ac

Using the above data, the following table estimates equipment and labor costs of revegetation.

	Acres	Hours	Equipment Cost	Labor Cost
Waste Rock	50	50 grader 25 drill	$4,000 1,250 4,750	$2,000 1,350
Roads	200	200 66	16,000 3,300 19,000	8,000 3,564
Ancillary Facilities	150	150 50	12,000 2,500 14,250	6,000 2,700
Leach pads	125	125 41	10,000 2,050 11,875	5,000 2,214
Total Revegetation Cost			$100,975	$30,828

Soil Stability - To meet the stability standard for Alternative 4 other measures would need to be implemented. Any steep slopes could have some erosion control problems, but the added cost of erosion control blankets would be needed above standard erosion and sediment control structures. For analysis purposes the following acreage would need erosion control blankets: waste rock 20 acres, roads 20 acres, leach pads 20 acres, for a total of 80 acres. Erosion control blankets cost $0.45/yd^2. For 80 acres @ 4840 yd^2/acre, for a total of 287,200 yd^2 to be covered, the total cost would amount to $174,240.

Fish and Wildlife - Under Alternative 4 within 10 years some areas of the mine might not return to the fish and wildlife habitat of premining status. Some offsite mitigation would be required to offset this loss. The common type of mitigation is vegetation manipulation. These types of actions take marginal habitat and change the vegetation to a more suitable habitat. Conversations with BLM biologists reveal that the average cost of such manipulation amounts to $1,000/acre. This analysis assumes that the pit and some of the haul roads would not be reclaimed within the 10 years and that 100 acres of vegetation would be manipulated at a cost of $100,000.

Wetlands - Alternative 4 would require that any wetlands would have to be restored within 10 years after a mine closes and is reclaimed. If this goal cannot be reached, then 1.5 times the amount of disturbed or lost land would need to be replaced. Reclamation is usually successful in restoring wetlands to proper functioning condition within 10 years. But open pit mines do remove wetlands in placing the pit or the waste rock dumps. This model assumes that 10 acres of wetlands would be lost to waste rock dumps.

The cost of offsite mitigation is estimated at the same cost as stream restoration under Alternative 4 of the placer mining model. For Alternative 4 the model assumes $2,500/acre (INTER-FLUVE, Inc. 1991), which is needed to meet the 10-year requirement for wetlands in properly functioning conditions. This analysis assumes stream restoration cost to be $2,500/acre for 15 acres for a total cost of $37,500.

Total Estimated Cost Changes: If the exploration operation is not within an area withdrawn for minerals, the project would incur the costs shown in Table E-40.

Table E-40. Alternative 4 -- Change in Costs for an Open Pit Project

Total Project Cost under Alternative 4:	$31,562,426
Change in Costs under Alternative 4 Due To:	
Bond Cost	418,400
Third Party Monitoring	35,500
Backfill Cost Minus Earthwork Cost	6,499,080
Applying Top Soil	(58,740)
Revegetation Cost	6,520
Soil Stabilization	174,240
Habitat Restoration	100,000
Validity Exam	10,000
Wetland Restoration	37,500
Total Change in Costs under Alternative 4:	7,215,980
Total Project Costs under Alternative 4:	38,778,400
Percent Change in Costs from Alternative 1 to Alternative 4:	23%

Alternative 5

Same as Alternative 3 except no validity exam would be required before operation could begin. There would be no added reclamation cost with backfilling.

Total Estimated Cost Changes: Estimated cost changes for an open pit mine are summarized in Table E-41.

Table E-41. Alternative 5 -- Change in Costs for an Open Pit Project

Total Project Cost under Alternative 1	$31,562,426
Change in Costs under Alternative 5 due to Bonding	364,700
Total Project Costs under Alternative 5	31,927,126
Percent Change in Costs from Alternative 1 to Alternative 5	1%

Cost Model Summary

Table E-42 outlines the change in cost and the percentage of change in cost between Alternative 1 and the others alternatives analyzed in this EIS.

Table E-42. Total Cost of Mine Models

	Alternative 1	Alternative 2	% Change	Alternative 3	% Change	Alternative 4	% Change	Alternative 5	% Change
Small Exploration	20,320	19,870	-2	20,820	+2	61,790	+203	28,820	+2
				41,820	+105				
Exploration	207,337	206,225	-1	208,697	0	319,514	+54	208,697	0
				301,197	+45				
Small Placer	319,320	311,400	-3	428,100	+34	483,320	+51	428,100	+34
				438,100	+37				
Placer	1,154,250	1,058,410	-3	1,238,050	+7	1,305,130	+13	1,238,00	+7
				1,248,050	+5				
Strip Mining/ Industrial Mineral	2,909,200	2,826,800	-2	3,005,200	+3	3,335,200	+15	3,005,200	+3
				3,035,200	+4				
Underground	875,400	875,400	0	963,300	+10	1,013,290	+16	963,300	+10
				973,300	+11				
Open Pit	31,562,462	30,948,300	-2	34,185,300	+8	38,778,400	+22	31,927,126	+1
				34,195,300	+8				

Discounted Cash Flow

In response to public comments, a summary of the discounted cash flow analysis developed for the Final Small Business and Regulatory Flexibility Act Analysis (USDI 2000) has been incorporated into this EIS. The modeled operations were all projected to employ 500 or fewer people. But the placer and exploration operations would be more likely to typify a mining firm with the potential to be faced with relatively greater impacts due to the regulation.

The cost models suggest that different types of operations would be expected to face different magnitudes of cost and profit changes. The impacts can further be categorized by (1) those that affect Existing Notices and Plans and (2) those that may affect new Notices and Plans.

New Notices and Plans

Placer Models: The analysis modeled the annual costs and revenues of a small and medium-size placer mine. This approach (in contrast to an approach that modeled streams of costs and revenues over the life of a mine) was chosen because placer operations typically make decisions to operate on an annual basis in response to current commodity market conditions and other factors. The small placer mine was assumed to be a Notice-level mine that would convert to a Plan of Operations under the new regulations. The medium size placer model was assumed to be a Plan-level operation under the existing and proposed regulations. This model would not incur any costs of "converting" to a Plan, but it would incur added reclamation and bonding costs. Both models assumed that operators did not incur labor or capital costs and that annual bonding costs amounted to 5% of total reclamation costs. It was also assumed that under the new regulations added reclamation requirements might be imposed on these operations. These requirements were modeled as an increase in reclamation costs from $10 to $17 per stream foot.

Because placer mining activities are very sensitive to gold prices and ore grades BLM has modeled a variety of different gold prices and ore grades. The results of the models for the medium and small placer mine show that these mines could face annual operating cost increases of up to 11% and 13%, respectively. Reductions in annual profits for the medium and small mines could range from 3% to 11% and 4% to 20%, respectively. The low end of the ranges represents higher ore grades and a gold price of $350 per ounce; the high end represents lower grade ore and a gold price of $250 per ounce.

Permitting costs were not included in the estimates of annual cost and profit changes. Permit costs are a fixed cost that would be incurred before mining. These costs can be highly variable depending on the nature, scope, and location of the activities. Permit costs could range from under $1,000 up to $100,000. Data is not available on the distribution of these costs across placer mining operations. In some locations, BLM is likely to bear a portion of these costs. If BLM were to bear all of these costs, the cost changes faced by operators would include only those for annual bonding and reclamation.

The magnitude of permitting costs will obviously affect both costs and profits. BLM recognizes that increases in upfront fixed permitting costs could result in some operators being precluded from mining. The regulations–not including permit costs–were estimated to reduce annual

527

profits by about $4,000 and $6,000 for the small and medium placer models, respectively. Under the low gold price-low ore grade scenario ($250 per ounce, 0.014 ounces/ton) annual profits were estimated to be about $20,000. These profits suggest that, given the model's assumptions, both the small and medium placer mines could absorb at least some increases in permitting costs. The extent to which they are able to do this depends on the magnitude of the permitting costs, ore grades, available capital, commodity prices, and management ability.

Open pit model: A medium-size open pit gold heap leach mine was modeled. This mine would submit a Plan under the existing and proposed regulations. Baseline permit costs were assumed to range from $200,000 - $1 million. With the regulation, permit costs were modeled as increasing from 0% to 50%. Under the regulation, backfilling was modeled to range from 0% to 25%. The "with regulation" situation was also modeled with and without a 1-year delay in mining. The cost of this delay is modeled as the mine owner's cost of capital multiplied by the capital investment. Bonding costs under the existing regulations were assumed to amount to 5% of the reclamation costs. Under the proposed regulations it was assumed that these costs would increase to 6%, representing a weighted average to account for the fact that corporate guarantees will no longer be allowed.

The model results are sensitive to the timing of the cost and revenue flows, as well as to the absolute magnitudes of permitting costs, the price of gold, and the percent of pit backfilling required. For example, delays, to the extent that they could be attributed directly to the regulatory changes, result in increased costs to mine owners as well as deferring variable mine operating costs and revenues. But the extent to which the regulation will result in delays relative to the existing baseline is not clear.

Across the "delay" and "no delay" models, the estimated cost changes range from 0% to 2%. The upper end of the range represents a 50% increase in baseline permit costs of $1 million and 25% backfilling. The lower end of the range represents no backfilling and changes in permit costs that range from 0% to 50%. In some cases costs appear to decline under the proposed regulations because including a delay in mining in the model also implies delaying variable operating costs. The delay in the occurrence of costs results in smaller costs on a present value basis.

Estimated changes in profits depend on assumptions about gold prices. At a price of $350 per ounce, profits are estimated to decline from about 0% to11%. At a gold price of $300 per ounce, profits decline by 1.5% to12%. At a price of $250 per ounce they decline by 2% to13%. The high end of each range is associated with baseline permit costs increasing from $1 million to $1.5 million and 25% backfilling.

Industrial/Strip: The industrial/strip mine was modeled as a gypsum mine operating under a Plan under both the existing and proposed regulations. The effect of the new regulations would be to potentially increase permitting costs and to require added bonding costs. The model included baseline permit costs ranging from $40,000 to $150,000, with up to a 50% increase in these costs. Bonding costs were assumed to represent 5% of reclamation costs. Costs were estimated to increase from 5% to 9%. The lower end of the range represents an increase in baseline permit costs of $40,000; the upper end of the range represents a 50% increase in baseline permit costs of

528

$150,000. Profits were estimated to decline by 8% to15% at a price of $7 per ton. The declines ranged from 6% to 11% at $8 per ton. Annual bonding costs and one-time permitting costs are the main components of the cost increases in this model. The requirement to bond at actual reclamation costs increases annual bonding costs from an estimated $6,500 to $16,000. If annual bonding costs were about $10,000, costs are estimated to increase by 5.5% and profits decline by 9% (assuming baseline permit costs of $100,000 increase by 50%).

Underground: A small notice-level underground mine was modeled under the assumption that this mine would operate for 5 years and be reclaimed for 2 years. The major change under the proposed regulations would be increased permitting, reclamation, and bonding costs. The operation would be required to file a Plan under the proposed regulations. Baseline permit costs were assumed to be $10,000, and these costs were modeled to increase to either $50,000 or $100,000. The model incorporated a 2-year delay in mining (relative to the base case) as well as a "no delay" scenario.

Results from the model reveal that the reduction in profits could range from 2% to 62%, depending on changes to permitting costs, the price of gold, and the extent to which "delays" were attributed to the regulation. If there are no delays (relative to the existing baseline) the model results indicate profit reductions by 2.3% to 5% if the price of gold is $350 per ounce; by 4.0% to 8.4% if the price of gold is $300 per ounce; and by17% to 36% if the price of gold is $250 per ounce. The low end of each range is associated with baseline permitting costs increasing from $10,000 to $50,000; the upper end of each range is associated with permitting costs increasing from $10,000 to $100,000.

Exploration: Two exploration models were developed: a small and medium-sized exploration operation. The small exploration model assumed a Notice-level operation that would be completed within a month. Baseline permit costs were assumed to be $200. This operation was assumed to remain at a Notice level under the proposed regulations. The major change would be increased reclamation and bonding costs. This project was modeled as disturbing 1 to 2 acres, and reclamation costs were estimated at $750. The operator was assumed to rely on a cash bond. The cost of the bond is modeled as the foregone interest that the miner would have earned on the bond amount.

The medium-size exploration model was assumed to require a Notice under the existing regulations. Under the proposed regulations the operation would be required to file a Plan. This operation was modeled as disturbing 4 acres. Baseline permit costs were assumed to be $1,000. It was assumed that this operation would be completed in under a year.

The primary factors responsible for the cost increases were bonding and permitting. The model assumed that a bond could be obtained for a cost equivalent to10% of the total reclamation cost. Results for both models were calculated with and without a validity exam. Validity exams were estimated to cost $10,000 per exam. For relatively small operations–such as many exploration activities–validity exam costs could represent a significant portion of permitting costs.

Increases in the magnitude of the permitting cost significantly affects any potential cost increases. For both of the exploration models there would be a distribution of permit costs under the proposed regulations. But data is not readily available to characterize these distributions. For the medium exploration model, permit costs were assumed to increase from a baseline level of $1,000 by $2,000 to $100,000, with the permit costs evenly distributed between the levels. Results from the model suggests that cost increases would range from 5% to 48%, with the weighted average cost increase being 24.4%. If a validity exam were not required, the range of cost increases would be 1% to 44%, with a weighted average of 20.1%.

For the small exploration model, permitting costs were assumed to increase from a baseline level of $200 to between $500 and $20,000. The extent to which costs increase depends on whether validity exams are required and whether BLM bears any of the increased permitting costs. It is likely that not all exploration activities will require validity exams, and in some cases BLM may bear some of the permitting costs. For the case where a validity exam is required and BLM does not bear any of the permitting costs, the cost increases could range from 54% to 150%. The high estimate is based on permit costs increasing from $200 to $20,000. The low estimate is based on permit costs increasing from $200 to $500. If a validity exam is not required, the cost increases are smaller: the range is 8% to 104%. The low estimate is based on permit costs increasing from $200 to $500; the high estimate is based on permit costs increasing from $200 to $20,000. If BLM bears all of the permitting costs and no validity exam is required, the cost increase is estimated at about 2%. The wide range of cost estimates generated by this model highlights the difficulty in estimating the potential cost increases associated with the regulation.

The large percentage cost increases for the exploration models need to be put in perspective. For the medium exploration model, baseline permit cost were modeled at $1,000; for the small exploration model these costs were modeled as being basically $0. In both cases, large percentage increases can be generated by relatively small absolute cost changes. Cost changes in the order of several hundred dollars–or even several thousands of dollars-- would be unlikely to have significant impacts, but do generate large percentage changes. But permit costs that increased from a baseline level of $0 to $50,000 or $100,000 could have significant impacts over the longer term.

APPENDIX F
PLANT AND ANIMAL LISTS

CONTENTS

Endangered, Threatened, and Proposed Species Known to Occur on BLM-Administered Lands 271

Amphibians and Reptiles Designated as Sensitive Species by BLM State Offices 286

Matrix of Regional Priority Bat Species Developed by the Bat Working Group (1998) 287

Priority Bird Species in the Western U.S. 290

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

State	Class	Common Name	Scientific Name	Status
Alaska				
	Bird	Eskimo curlew	Numenius borealis	FE
	Bird	Short-tailed albatross	Phoebastris albatrus	PE
	Bird	Spectacled eider	Somateria fischeri	FT
	Bird	Stellar's eider	Polystricta stelleri	FT
	Mammal	Canada lynx	Lynx canadensis	FT
	Mammal	Steller's (Northern) sea lion	Eumetopias jubatus	FT
Arizona				
	Amphibia	Sonora tiger salamander	Ambystoma tigrinum stebbinsi	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Brown pelican	Pelecanus occidentalis	FE
	Bird	Cactus ferruginous pygmy-owl	Glaucidium brasilianum cactorum	FE
	Bird	California condor	Gymnogyps californianus	FE (XN)
	Bird	Mexican spotted owl	Strix occidentalis lucida	FT
	Bird	Northern aplomado falcon	Falco femoralis septentrionalis	FE
	Bird	Peregrine falcon	Falco peregrinus	FE (S/A)
	Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
	Bird	Whooping crane	Grus americana	FE
	Bird	Yuma clapper rail	Rallus longirostris yumanensis	FE
	Fish	Beautiful shiner	Cyprinella formosa	FT
	Fish	Bonytail chub	Gila elegans	FE
	Fish	Colorado squawfish	Ptychocheilus lucius	FE
	Fish	Desert pupfish	Cyprinodon macularius	FE
	Fish	Gila topminnow	Poeciliopsis occidentalis	FE
	Fish	Little Colorado spinedace	Lepidomeda vittata	FT
	Fish	Loach minnow	Rhinichthys (=Tiaroga) cobitis	FT
	Fish	Razorback sucker	Xyrauchen texanus	FE
	Fish	Sonora chub	Gila ditaenia	FT
	Fish	Spikedace	Meda fulgida	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Fish	Virgin River chub	Gila robusta seminuda	FE
Fish	Woundfin	Plagopterus argentissimus	FE
Fish	Yaqui catfish	Ictalurus pricei	FT
Fish	Yaqui chub	Gila prupurea	FE
Fish	Yaqui topminnow	Poeciliopsis occidentalis sonoriensis	FE
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Hualapai Mexican vole	Microtus mexcanus hualapaiensis	FE
Mammal	Jaguar	Panthera onca	FE
Mammal	Jaguarundi	Felis yaguarundi	FE
Mammal	Lesser long-nosed bat	Leptonycteris curasoae yerbabuenae	FE
Mammal	Mexican gray wolf	Canis lupus baileyi	FE
Mammal	Ocelot	Felis pardalis	FE
Mammal	Sonoran pronghorn	Antilocapra americana	FE
Mollusk	Kanab ambersnail	Oxyloma Haydeni kanabensis	FE
Plant	Arizona agave	Agave arizonica	FE
Plant	Arizona cliffrose	Purshia subintegra	FE
Plant	Arizona hedgehog cactus	Echinocereus triglochidiatus arizonicus	FE
Plant	Brady pincushion cactus	Pediocactus bradyi	FE
Plant	Canelo Hills ladies tresses	Spiranthes delitescens	FE
Plant	Cochise pincushion cactus	Coryphantha robbinsorum	FT
Plant	Huachuca water umbel	Lilaeopsis schaffneriana ssp recurva	FE
Plant	Jones cycladenia	Cycladenia humilis var. jonesii	FT
Plant	Kearneys blue star	Amsonia kearneyana	FE
Plant	Nichol's Turk's head cactus	Echinocactus horizonthalonius var. nicholii	FE
Plant	Peebles Navajo cactus	Pediocactus peeblesianus var. peeblesianus	FE
Plant	Pima pineapple cactus	Coryphantha scheeri var. robustispina	FE
Plant	Siler pincushion cactus	Pediocactus sileri	FT
Plant	Welsh's milkweed	Asclepias welshii	FT
Reptile	Desert tortoise (Mojave pop.)	Gopherus agassizii	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

	Reptile	New Mexican ridge-nosed rattlesnake	Crotalus willardi obscurus	FT
Californi				
	Amphibia	California red-legged frog	Rana aurora draytonii	FT
	Amphibian	Desert slender salamander	Batrachoseps aridis	FE
	Arthropod	Conservancy fairy shrimp	Branchinecta conservatio	FE
	Arthropod	Kern primrose sphinx moth	Euproserpinus euterpe	FT
	Arthropod	Longhorn fairy shrimp	Branchinecta longiantenna	FE
	Arthropod	Valley elderberry longhorn beetle	Desmocerus californicus dimorphus	FT
	Arthropod	Vernal pool fairy shrimp	Branchinecta lynchi	FE
	Arthropod	Vernal pool tadpole shrimp	Lepidurus packardi	FE
	Bird	Aleutian Canada goose	Branta canadensis leucopareia	FT
	Bird	American peregrine falcon	Falco peregrinus anatum	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Brown pelican	Pelecanus occidentalis	FE
	Bird	California condor	Gymnogyps californianus	FE
	Bird	Coastal California gnatcatcher	Polioptila californica californica	FT
	Bird	Inyo California (=brown) towhee	Pipilo crissalis eremophilus	FT
	Bird	Least Bell's vireo	Vireo bellii pusillus	FE
	Bird	Marbled murrelet	Brachyramphus marmoratus marmoratus	FT
	Bird	Mountain plover	Charadrius montanus	PT
	Bird	Northern spotted owl	Strix occidentalis caurina	FT
	Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
	Bird	Yuma clapper rail	Rallus longirostris yumanensis	FE
	Fish	Cowhead Lake tui chub	Gila bicolor vaccaceps	PE
	Fish	Desert pupfish	Cyprinodon macularius	FE
	Fish	Lahontan cutthroat trout	Oncorhynchus clarki henshawi	FT
	Fish	Lost River sucker	Deltistes (=Catostomus) luxatus	FE
	Fish	Modoc sucker	Catostomus microps	FE
	Fish	Mohave tui chub	Gila bicolor mohavensis	FE

Appendix F: Plant and Animal Lists

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Fish	Owens pupfish	Cyprinodon radiosus	FE
Fish	Owens tui chub	Gila bicolor snyderi	FE
Fish	Shortnose sucker	Chasmistes brevirostris	FE
Fish	Unarmored three-spine stickleback	Gasterosteus aculeatus williamsoni	FE
Fish*	Chinook salmon, winter-run	Oncorhynchus tshawytscha	FE
Fish*	Coho salmon (Central California ESU)	Oncorhynchus kisutch	FT
Fish*	Coho salmon (Southern OR/Nortern	Oncorhynchus kisutch	FT
Fish*	Steelhead trout (CA Central Valley ESU)	Oncorhynchus mykiss	FT
Fish*	Steelhead trout (Central CA Coast ESU)	Oncorhynchus mykiss	FT
Fish*	Steelhead trout (Klamath Mountain Province ESU)	Oncorhynchus mykiss	PT
Fish*	Steelhead trout (Northern CA ESU)	Oncorhynchus mykiss	PT
Fish*	Steelhead trout (Southern CA ESU)	Oncorhynchus mykiss	FE
Mammal	Amargosa vole	Microtus californicus scirpensis	FE
Mammal	Fresno kangaroo rat	Dipodomys nitratoides exilis	FE
Mammal	Giant kangaroo rat	Dipodomys ingens	FE
Mammal	Peninsular bighorn sheep	Ovis canadensis cremnobates	FE
Mammal	San Joaquin kit fox	Vulpes macrotis mutica	FE
Mammal	San Joaquin Valley woodrat	Neotoma fuscipes riparia	PE
Mammal	Stephen's kangaroo rat	Dipodomys stephensi	FE
Mammal	Tipton kangaroo rat	Dipodomys nitratoides nitratoides	FE
Plant	Amargosa niterwort	Nitrophila mohavensis	FE
Plant	Ash Meadows gumplant	Grindelia fraxino-pratensis	FT
Plant	Bakersfield cactus	Opuntia treleasei	FE
Plant	Beach layia	Layia carnosa	FE
Plant	California jewelflower	Caulanthus californicus	FE
Plant	Coachella Valley milk-vetch	Astragalus lentiginosus var. coachellae	FT
Plant	Cushenberry buckwheat	Eriogonum ovalifolium var. vineum	FE
Plant	Cushenberry milk-vetch	Astragalus albens	FE

535

Appendix F: Plant and Animal Lists

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Plant	Cushenberry oxytheca	Oxytheca parishii var. goodmaniana	FE
Plant	El Dorado bedstraw	Galium californicum ssp. sierrae	FE
Plant	Fish Slough milk-vetch	Astragalus lentiginosus var. piscinensis	PE
Plant	Fleshy owl's clover	Castilleja campestris ssp. succulenta	FT
Plant	Hoover's woolystar	Eriastrum hooveri	FT
Plant	Indian Knob mountain balm	Eriodictyon altissimum	FE
Plant	Ione manzanita	Arctostaphylos myrtifolia	FT
Plant	Kern mallow	Eremalche kernensis	FE
Plant	Lane Mtn. milk-vetch	Astragalus jaegerianus	FE
Plant	Layne's butterweed	Senecio layneae	FT
Plant	McDonald's rock-cress	Arabis mcdonaldiana	FE
Plant	Menzies' wallflower	Erysimum menziesii	FE
Plant	Mexican fremontia	Fremontodendron mexicanum	FE
Plant	Munz's onion	Allium munzii	FE
Plant	Nevin's barberry	Berberis nevinii	FE
Plant	Otay tarplant	Hemizonia conjugens	FT
Plant	Parish's daisy	Erigeron parishii	FT
Plant	Peirson's milk-vetch	Astragalus magdalenae var. peirsonii	FT
Plant	Pine Hill ceanothus	Ceanothus roderickii	FE
Plant	Pine Hill flannelbush	Fremontodendron californicum ssp. decumbens	FE
Plant	Red Hills vervain	Verbena californica	FT
Plant	San Benito evening-primrose	Camissonia benitensis	FT
Plant	San Jacinto Valley crownscale	Atriplex coronata var. Notatior	FE
Plant	San Joaquin Valley orcutt grass	Orcuttia inaequalis	FT
Plant	San Joaquin woolly threads	Lembertia congdonii	FE
Plant	Santa Ana River woolystar	Eriastrum densifolium ssp. sanctorum	FE
Plant	Slender orcutt grass	Orcuttia tenuis	FT
Plant	Slender-horned spineflower	Dodecahema leptoceras	FE
Plant	Spring-loving centaury	Centaurium namophilum	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Plant	Springville clarkia	Clarkia springvillensis	FT
Plant	Stebbins' morning glory	Calystegia stebbinsii	FE
Plant	Thread-leaved brodiaea	Brodiaea filifolia	FT
Plant	Triple-ribbed milkvetch	Astragalus tricarinatus	FE
Reptile	Blunt-nosed leopard lizard	Gambelia silus	FE
Reptile	Coachella Valley fringe-toed lizard	Uma inornata	FT
Reptile	Desert tortoise (Mojave pop.)	Gopherus agassizii	FT
Reptile	Giant garter snake	Thamnophis gigas	FT

Colorado

Arthropod	Pawnee montane skipper	Hesperia leonardus montana	FT
Arthropod	Uncomphagre fritillary butterfly	Boloria improba acrocnema	FE
Bird	American peregrine falcon	Falco peregrinus anatum	FE
Bird	Bald eagle	Haliaeetus leucocephalus	FT
Bird	Eskimo curlew	Numenius borealis	FE
Bird	Least tern (interior pop.)	Sterna antillarum	FE
Bird	Mexican spotted owl	Strix occidentalis lucida	FT
Bird	Mountain plover	Charadrius montanus	PT
Bird	Piping plover	Charadrius melodus	FT
Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
Bird	Whooping crane	Grus americana	FE
Fish	Bonytail chub	Gila elegans	FE
Fish	Colorado squawfish	Ptychocheilus lucius	FE
Fish	Greenback cutthroat trout	Oncorhynchus clarki stomias	FT
Fish	Humpback chub	Gila cypha	FE
Fish	Pallid sturgeon	Scaphirhynchus albus	FE
Fish	Razorback sucker	Xyrauchen texanus	FE
Mammal	Black-footed ferret	Mustela nigripes	FE (XN)
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Canada lynx	Lynx canadensis	FT
Mammal	Gray wolf	Canis lupus	FE

Appendix F: Plant and Animal Lists

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Mammal	Grizzly (=brown) bear	Ursus arctos	FT
Mammal	Preble's meadow jumping mouse	Zapus hudsonius preblei	FT
Plant	Clay-loving wild buckwheat	Eriogonum pelinophilum	FE
Plant	Colorado butterfly plant	Gaura neomexicana ssp. coloradensis	PT
Plant	Dudley bluffs bladderpod	Lesquerella congesta	FT
Plant	Knowlton cactus	Pediocactus knowltonii	FE
Plant	Mancos milk-vetch	Astragalus humillimus	FE
Plant	Mesa Verde cactus	Sclerocactus mesae-verdae	FT
Plant	North Park phacelia	Phacelia formosula	FE
Plant	Osterhout milkvetch	Astragalus osterhoutii	FE
Plant	Penland alpine fen mustard	Eutrema penlandii	FT
Plant	Piceance twinpod	Physaria obcordata	FT

Idaho

Bird	American peregrine falcon	Falco peregrinus anatum	FE
Bird	Bald eagle	Haliaeetus leucocephalus	FT
Bird	Whooping crane	Grus americana	FE
Fish	Bull trout (Columbia River pop)	Salvelinus confluentus	FT
Fish	Bull trout (Jarbridge River pop)	Salvelinus confluentus	FE
Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT
Fish	Kootenai River white sturgeon	Acipenser transmontanus	FE
Fish	Sockeye salmon	Oncorhynchus nerka	FE
Fish*	Chinook salmon, fall run (Snake River pop)	Oncorhynchus tshawytscha	FT
Fish*	Chinook salmon, spring/summer run (Snake River pop)	Oncorhynchus tshawytscha	FT
Fish*	Steelhead trout (Snake River Basin ESU)	Oncorhynchus mykiss	FT
Mammal	Gray wolf	Canis lupus	FE
Mammal	Grizzly (=brown) bear	Ursus arctos	FT
Mammal	Lynx	Lynx canadensis	FT
Mammal	Northern Idaho ground squirrel	Spermophilus brunneus brunneus	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

	Mammal	Woodland (Mountain) caribou	Rangifer tarandus caribou	FE
	Mollusk	Banbury Springs limpet	Lanx sp.	FE
	Mollusk	Bliss Rapids snail	Taylorconcha serpenticola	FT
	Mollusk	Bruneau Hot Springsnail	Pyrgulopsis bruneauensis	FE
	Mollusk	Idaho springsnail	Pyrgulopsis idahoensis	FE
	Mollusk	Snake River physa snail	Physa natricina	FE
	Mollusk	Utah valvata snail	Valvata utahensis	FE
	Plant	Macfarlanes four-o'clock	Mirabilis macfarlanei	FT
	Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT
	Plant	Water howellia	Howellia aquatilis	FT
Montana				
	Arthropod	American burying beetle	Nicrophorus americanus	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Eskimo curlew	Numenius borealis	FE
	Bird	Least tern (interior pop.)	Sterna antillarum	FE
	Bird	Mountain plover	Charadrius montanus	PT
	Bird	Peregrine falcon	Falco peregrinus	FE (S/A)
	Bird	Piping plover	Charadrius melodus	FT
	Bird	Whooping crane	Grus americana	FE
	Fish	Bull trout (Columbia River pop)	Salvelinus confluentus	FT
	Fish	Pallid sturgeon	Scaphirhynchus albus	FE
	Mammal	Black-footed ferret	Mustela nigripes	FE
	Mammal	Gray wolf	Canis lupus	FE
	Mammal	Grizzly (=brown) bear	Ursus arctos	FT
	Mammal	Lynx	Lynx canadensis	FT
N.				
	Arthropod	Socorro isopod	Exosphaeroma thermophilus	FE
	Bird	American peregrine falcon	Falco peregrinus anatum	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Brown pelican	Pelecanus occidentalis	FE

Appendix F: Plant and Animal Lists

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Bird	Least tern (interior pop.)	Sterna antillarum	FE
Bird	Mexican spotted owl	Strix occidentalis lucida	FT
Bird	Mountain plover	Charadrius montanus	PT
Bird	Northern aplomado falcon	Falco femoralis septentrionalis	FE
Bird	Piping plover	Charadrius melodus	FT
Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
Bird	Whooping crane	Grus americana	FE
Fish	Arkansas River shiner	Notropis girardi	FT
Fish	Beautiful shiner	Cyprinella formosa	FT
Fish	Colorado squawfish	Ptychocheilus lucius	FE
Fish	Gila topminnow	Poeciliopsis occidentalis	FE
Fish	Gila trout	Oncorhynchus gilae	FE
Fish	Loach minnow	Rhinichthys (=Tiaroga) cobitis	FT
Fish	Pecos bluntnose shiner	Notropis simus pecosensis	FT
Fish	Pecos gambusia	Gambusia nobilis	FE
Fish	Razorback sucker	Xyrauchen texanus	FE
Fish	Rio Grande silvery minnow	Hybognathus amarus	FE
Fish	Spikedace	Meda fulgida	FT
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Jaguar	Panthera onca	FE
Mammal	Lesser long-nosed bat	Leptonycteris curasoae yerbabuenae	FE
Mammal	Mexican gray wolf	Canis lupus baileyi	FE
Mammal	Mexican long-nosed bat	Leptonycteris nivalis	FE
Mollusk	Alamosa springsnail	Tryonia alamosae	FE
Mollusk	Socorro Springsnail	pyrgulopsis neomexicana	FE
Plant	Gypsum wild-buckwheat	Eriogonum gypsophilum	FT
Plant	Holy Ghost ipomopsis	Ipomopsis sancti-spiritus	FE
Plant	Knowlton cactus	Pediocactus knowltonii	FE
Plant	Kuenzler hedgehog cactus	Echinocereus fendleri var. Kuenzleri	FE
Plant	Lee pincushion cactus	Coryphantha sneedii var. leei	FT

Appendix F: Plant and Animal Lists

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Plant	Mancos milk-vetch	Astragalus humillimus	FE
Plant	Mesa Verde cactus	Sclerocactus mesae-verdae	FT
Plant	Sacramento prickly poppy	Argemone Plieiacantha ssp.pinnatisecta	FE
Plant	Sneed pincushion cactus	Coryphantha sneedii var. sneedii	FE
Plant	Todsen's pennyroyal	Hedeoma todsenii	FE
Plant	Zuni (=rhizome) fleabane	Erigeron rhizomatus	FT
Reptile	New Mexican ridge-nosed rattlesnake	Crotalus willardi obscurus	FT

Nevada

Arthropod	Ash Meadows naucorid bug	Ambrysus amargosus	FT
Bird	Bald eagle	Haliaeetus leucocephalus	FT
Bird	Mountain plover	Charadrius montanus	PT
Bird	Peregrine falcon	Falco peregrinus	FE (S/A)
Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
Fish	Ash Meadows Amargosa pupfish	Cyprinodon nevadensis mionectes	FE
Fish	Big Spring spinedace	Lepidomeda mollispinis pratensis	FT
Fish	Bonytail chub	Gila elegans	FE
Fish	Bull trout (Jarbridge River pop)	Salvelinus confluentus	FE
Fish	Clover Valley speckled dace	Rhinichthys osculus oligoporus	FE
Fish	Cui-ui	Chasmistes cujus	FE
Fish	Desert dace	Eremichthys acros	FT
Fish	Devil's Hole pupfish	Cyprinodon diabolis	FE
Fish	Hiko White River springfish	Crenichthys baileyi grandis	FE
Fish	Independence Valley speckled dace	Rhinichthys osculus lethoporus	FE
Fish	Lahontan cutthroat trout	Oncorhynchus clarki henshawi	FT
Fish	Moapa dace	Moapa coriacea	FE
Fish	Nevada speckled dace	Rhinichthys osculus nevadensis	FE
Fish	Pahranagat roundtail chub	Gila robusta jordani	FE
Fish	Pahrump poolfish	Empetrichthys latos	FE
Fish	Railroad Valley springfish	Crenichthys nevadae	FT
Fish	Razorback sucker	Xyrauchen texanus	FE

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

	Fish	Virgin River chub	Gila robusta seminuda	FE
	Fish	Warm Springs pupfish	Cyprinodon nevadensis pectoralis	FE
	Fish	Warner sucker	Catostomus warnerensis	FT
	Fish	White River spinedace	Lepidomeda albivallis	FE
	Fish	White River springfish	Crenichthys baileyi baileyi	FE
	Fish	Woundfin	Plagopterus argentissimus	FE
	Plant	Amargosa niterwort	Nitrophila mohavensis	FE
	Plant	Ash Meadows blazingstar	Mentzelia leucophylla	FT
	Plant	Ash Meadows gumplant	Grindelia fraxino-pratensis	FT
	Plant	Ash Meadows ivesia	Ivesia kingii var. eremica	FT
	Plant	Ash Meadows milkvetch	Astragalus phoenix	FT
	Plant	Ash Meadows sunray	Enciliopsis nudicaulis var. corrugata	FT
	Plant	Spring-loving centaury	Centaurium namophilum	FT
	Plant	Steamboat buckwheat	Eriogonum ovalifolium var. williamsiae	FE
	Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT
	Reptile	Desert tortoise (Mojave pop.)	Gopherus agassizii	FT
Oregon				
	Arthropod	Fender's blue butterfly	Icaricia icarioides fenderi	FE
	Arthropod	Oregon silverspot butterfly	Speyeria zerene hippolyta	FT
	Bird	Aleutian canada goose	Branta canadensis leucopareia	FT
	Bird	American peregrine falcon	Falco peregrinus anatum	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Brown pelican	Pelecanus occidentalis	FE
	Bird	California condor	Gymnogyps californianus	FE
	Bird	Eskimo curlew	Numenius borealis	FE
	Bird	Marbled murrelet	Brachyramphus marmoratus marmoratus	FT
	Bird	Northern spotted owl	Strix occidentalis caurina	FT
	Bird	Peregrine falcon	Falco peregrinus	FE (S/A)

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Bird	Short-tailed albatross	Phoebastris albatrus	PE
Bird	Western snowy plover (coastal pop)	Charadrius alexandrinus nivosus	FT
Fish	Borax lake chub	Gila boraxobius	FE
Fish	Bull trout (Columbia River pop)	Salvelinus confluentus	FT
Fish	Bull trout (Klamath River pop)	Salvelinus confluentus	FT
Fish	Foskett speckled dace	Rhinichthys osculus ssp. 3	FT
Fish	Hutton tui chub	Gila bicolor ssp. 1	FT
Fish	Lahontan cutthroat trout	Oncorhynchus clarki henshawi	FT
Fish	Lost River sucker	Deltistes (=Catostomus) luxatus	FE
Fish	Oregon chub	Oregonichthys (=Hybopsis) crameri	FE
Fish	Shortnose sucker	Chasmistes brevirostris	FE
Fish	Warner sucker	Catostomus warnerensis	FT
Fish*	Chinook salmon, fall run (Snake River pop)	Oncorhynchus tshawytscha	FT
Fish*	Chinook salmon, spring/summer run (Snake River pop)	Oncorhynchus tshawytscha	FT
Fish*	Coho salmon (Oregon Coast ESU)	Oncorhynchus kisutch	FT
Fish*	Coho salmon (Southern OR/Nortern	Oncorhynchus kisutch	FT
Fish*	Sockeye salmon, snake river runs	Oncorhynchus nerka	FE
Fish*	Steelhead trout (Klamath Mountain Province ESU)	Oncorhynchus mykiss	PT
Fish*	Steelhead trout (Middle Columbia River ESU)	Oncorhynchus mykiss	FT
Fish*	Steelhead trout (Oregon Coast ESU)	Oncorhynchus mykiss	PT
Fish*	Steelhead trout (Snake River Basin ESU)	Oncorhynchus mykiss	FT
Fish*	Steelhead trout (Upper Columbia River ESU)	Oncorhynchus mykiss	FE
Fish*	Umpqua river cutthroat trout	Oncorhynchus clarki clarki	FE
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Columbian white-tailed deer	Odocoileus virginianus leucurus	FE
Mammal	Gray wolf	Canis lupus	FE
Mammal	Grizzly (=brown) bear	Ursus arctos	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Mammal	Lynx	Lynx canadensis	FT
Mammal	Woodland (Mountain) caribou	Rangifer tarandus caribou	FE
Plant	Applegate's milk-vetch	Astragalus applegatei	FE
Plant	Bradshaw's lomatium/Desert-parsley	Lomatium bradshawii	FE
Plant	Gentner's fritillaria	Fritillaria gentneri	FE
Plant	Golden paintbrush	Castilleja levisecta	FT
Plant	Hairy popcorn flower or rough allocarya	Plagiobothrys hirtus	FE
Plant	Howell's spectacular thelypody	Thelypodium howellii ssp. Spectabilis	FT
Plant	Kincaid's lupine	Lupinus sulphureus ssp. Kincaidii	FT
Plant	Macfarlanes four-o'clock	Mirabilis macfarlanei	FT
Plant	Malheur wire-lettuce	Stephanomeria malheurensis	FE
Plant	Marsh sandwort	Arenaria paludicola	FE
Plant	Nelson's checkermallow	Sidalcea nelsoniana	FT
Plant	Oregon checkermallow	Sidalcea oregana var. Calva	FE
Plant	Water howellia	Howellia aquatilis	FT
Plant	Western lily	Lilium occidentale	FE
Plant	Willamette daisy	Erigeron decumbens var. Decumbens	FE

Utah

Bird	American peregrine falcon	Falco peregrinus anatum	FE
Bird	Bald eagle	Haliaeetus leucocephalus	FT
Bird	Mexican spotted owl	Strix occidentalis lucida	FT
Bird	Mountain plover	Charadrius montanus	PT
Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
Bird	Whooping crane	Grus americana	FE
Fish	Bonytail chub	Gila elegans	FE
Fish	Colorado squawfish	Ptychocheilus lucius	FE
Fish	Humpback chub	Gila cypha	FE
Fish	Lahontan cutthroat trout	Oncorhynchus clarki henshawi	FT
Fish	Razorback sucker	Xyrauchen texanus	FE
Fish	Virgin River chub	Gila robusta seminuda	FE

Appendix F: Plant and Animal Lists

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Fish	Woundfin	Plagopterus argentissimus	FE
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Black-footed ferret	Mustela nigripes	FE (XN)
Mammal	Lynx	Lynx canadensis	FT
Mammal	Utah prairie dog	Cynomys parvidens	FT
Mollusk	Kanab ambersnail	Oxyloma Haydeni kanabensis	FE
Plant	Barneby reed-mustard	Schoenocrambe barneby	FE
Plant	Barneby ridge-cress	Lepidium barnebyanum	FE
Plant	Clay reed-mustard	Schoenocrambe argillacea	FT
Plant	Deseret milk-vetch	Astragalus desereticus	FT
Plant	Dwarf bear-claw poppy	Arctomecon humilis	FE
Plant	Jones cycladenia	Cycladenia humilis var. jonesii	FT
Plant	Kodachrome bladderpod	Lesquerella tumulosa	FE
Plant	Last Chance townsendia	Townsendia aprica	FT
Plant	Maguire daisy	Erigeron maguirei	FT
Plant	Navajo sedge	Carex specuicola	FT
Plant	San Rafael cactus	Pediocactus despainii	FE
Plant	Shrubby reed-mustard	Schoenocrambe suffrutescens	FE
Plant	Siler pincushion cactus	Pediocactus sileri	FT
Plant	Uinta Basin hookless cactus	Sclerocactus glaucus	FT
Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT
Plant	Welsh's milkweed	Asclepias welshii	FT
Plant	Winkler cactus	Pediocactus winkleri	FT
Plant	Wright fishhook cactus	Sclerocactus wrightiae	FE
Reptile	Desert tortoise (Mojave pop.)	Gopherus agassizii	FT

Wyoming

Amphibia	Wyoming toad	Bufo hemiophyrs baxteri	FE
Arthropod	American burying beetle	Nicrophorus americanus	FE
Bird	Bald eagle	Haliaeetus leucocephalus	FT
Bird	Eskimo curlew	Numenius borealis	FE

Appendix F: Plant and Animals Lists

Bird	Least tern (interior pop.)	Sterna antillarum	FE
Bird	Mountain plover	Charadrius montanus	PT
Bird	Peregrine falcon	Falco peregrinus	FE (S/A)
Bird	Piping plover	Charadrius melodus	FT
Bird	Whooping crane	Grus americana	FE
Fish	Bonytail chub	Gila elegans	FE
Fish	Colorado squawfish	Ptychocheilus lucius	FE
Fish	Humpback chub	Gila cypha	FE
Fish	Kendall Warm Springs dace	Rhinichthys osculus thermalis	FE
Fish	Pallid sturgeon	Scaphirhynchus albus	FE
Fish	Razorback sucker	Xyrauchen texanus	FE
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Gray wolf	Canis lupus	FE
Mammal	Grizzly (=brown) bear	Ursus arctos	FT
Mammal	Lynx	Lynx canadensis	FT
Mammal	Preble's meadow jumping mouse	Zapus hudsonius preblei	FT
Plant	Colorado butterfly plant	Gaura neomexicana ssp. coloradensis	PT
Plant	Desert Yellowhead	Yermo xanthocephalus	PT
Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT

Amphibians and Reptiles Designated as Sensitive Species by BLM State Offices

- Amargosa toad
- Arizona toad
- Arizona skink
- Banded Gila monster
- Blanchard's cricket frog
- California king snake
- Canadian toad
- Canyon spotted whiptail
- Canyon whiptail
- Cascades frog
- Chuckwalla
- Coeur d'Alene salamander
- Collard lizard (Mojave black)
- Common kingsnake
- Cowles fringe-toed lizard
- Desert night lizard
- Desert spiny lizard
- Desert iguana
- Desert tortoise (Sonoran Desert)
- Desert glossy snake
- Desert horned lizard
- Dunes sagebrush lizard
- Eastern short-horned lizard
- Flat-tailed horned lizard
- Glen Canyon chuckwalla
- Gray-checkered whiptail
- Great Plains rat snake
- Jemez Mountain salamander
- Larch Mountain salamander
- Longnose leopard lizard
- Lowland leopard frog
- Massasauga
- Mexican garter snake
- Midget-faded rattlesnake
- Milk snake
- Mojave black-collard lizard
- Mojave Desert sidewinder
- Mojave patch-nosed snake
- Narrow-headed garter snake
- Narrowhead garter snake
- Northern leopard frog
- Northern red-legged frog
- Northern sagebrush lizard
- Northwestern pond turtle
- Pacific chorus frog
- Painted Desert glossy snake
- Plains leopard frog
- Plateau striped whiptail
- Ringneck snake
- Rosy boa
- Sacramento Mountain salamander
- Smooth green snake
- Snapping turtle
- Sonora lyre snake
- Sonora tiger salamander
- Southern torrent salamander
- Southwestern black snake
- Southwestern speckled rattlesnake
- Spiny softshell turtle
- Spotted frog
- Tailed frog
- Tarahumara frog
- Texas horned lizard
- Utah banded gecko
- Utah blind snake
- Utah milk snake
- Utah mountain king snake
- Western toad
- Western chuckwalla
- Western ground snake
- Wood frog

Matrix of Regional Priority Bat Species Developed by the Bat Working Group (1998)

Species	Region 1	Region 2	Regions 3, 4, 9, 10	Region 5	Region 6	Regions 7, 8
MULTIPLE HABITAT BATS						
Southwestern myotis						M
California myotis	L	M	L	L	M	L
Western small-footed myotis	P	M	L	M	M	M
Long-eared myotis	M	M	L	M	M	M
Keen's myotis	H					
Little brown bat	L	L	L	M	M	M
Arizona myotis						M
Northern myotis			L			
Fringed myotis	H	H	M	H	H	M
Long-legged myotis	M	M	L	H	L	M
Yuma myotis	L	M	L	L	M	L
Big brown bat	L	L	L	L	L	L
Lappet-eared bat					H	H
Pallid bat	H	M	L	H	M	L
Mexican free-tailed bat	L		L	L	M	L
TREE-ROOSTING BATS						
Western red bat				H	H	H
Eastern red bat			L			
Hoary bat	M	M	M	M	M	M
Western yellow bat				H		H
Silver-haired bat	M	M	M	M	M	M

H = high priority; M = medium priority; L = low priority; P = periphery (species on the edge of its range).

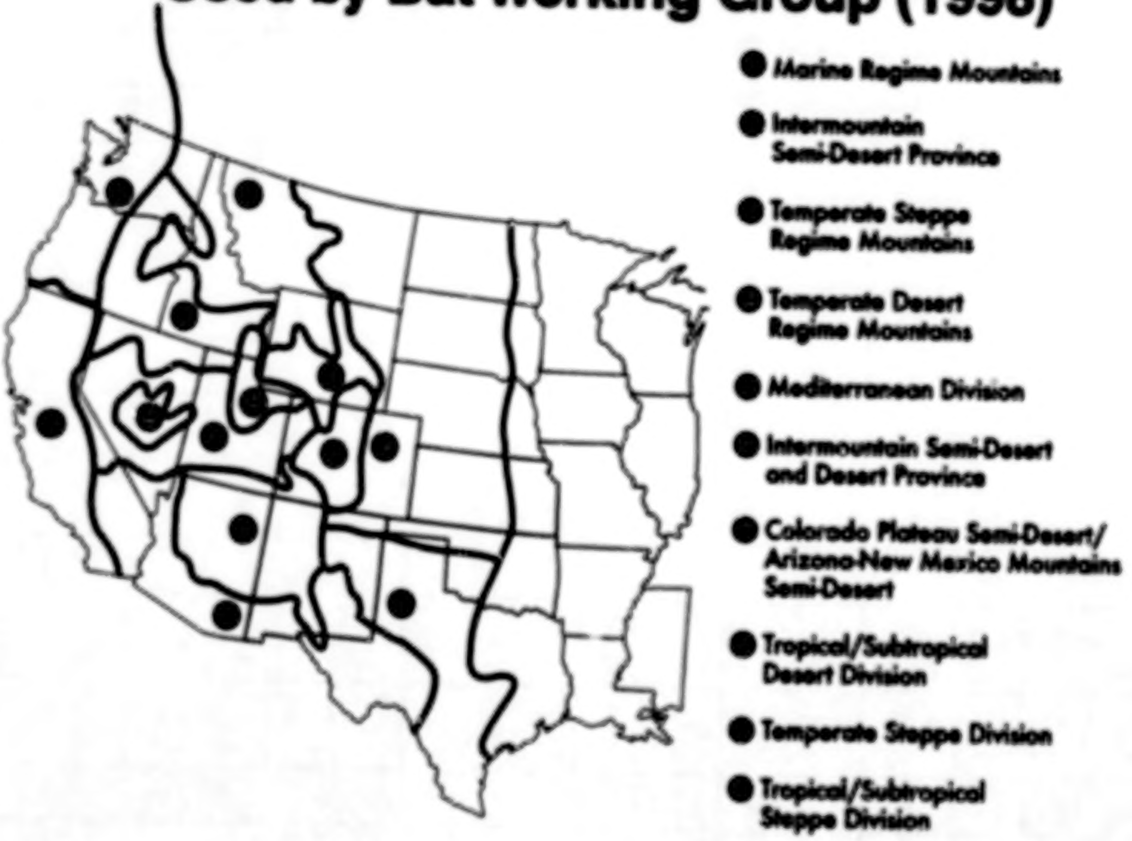
Matrix of Regional Priority Bat Species Developed by the Bat Working Group (1998)

Species	Region 1	Region 2	Regions 3, 4, 9, 10	Region 5	Region 6	Regions 7, 8
CLIFF-ROOSTING BATS						
Western pipestrelle	P	L	L	L	M	L
Spotted bat	P	H	M	H	H	M
Pocketed free-tailed bat				M		M
Big free-tailed bat			L	M	H	M
Western mastiff bat				H	H	M
Underwood's mastiff bat						M
CAVE-ROOSTING BATS						
Ghost-faced bat						M
California leaf-nosed bat				H		H
Mexican long-tongued bat				M		H
Lesser long-nosed bat						H
Big long-nosed bat						H
Cave myotis			L			M
Townsend's big-eared bat	H	H	H	H	H	H

H = high priority; M = medium priority; L = low priority; P = periphery (species on the edge of its range).

Figure F-1

Priority Bat Species Regions Used by Bat Working Group (1998)


● Marine Regime Mountains
● Intermountain Semi-Desert Province
● Temperate Steppe Regime Mountains
● Temperate Desert Regime Mountains
● Mediterranean Division
● Intermountain Semi-Desert and Desert Province
● Colorado Plateau Semi-Desert/ Arizona-New Mexico Mountains Semi-Desert
● Tropical/Subtropical Desert Division
● Temperate Steppe Division
● Tropical/Subtropical Steppe Division

Partners In Flight Western Working Group Group Priority Bird Species in the Western U.S.
177 Species on the List of One or More States

10 October 1997

Abert's Towhee
American Pipit
American Redstart
American Bittern
Aplomado Falcon
Arctic Warbler
Baird's Sparrow (3)
Bald Eagle (3)
Band-tailed Pigeon (3)
Bank Swallow (3)
Bell's Vireo (5)
Belted Kingfisher
Bendire's Thrasher (2)
Black-billed Cuckoo
Black-throated Gray Warbler (5)
Black Swift (5)
Black Rail
Black Tern (2)
Black-throated Sparrow (2)
Black-backed Woodpecker
Black-chinned Sparrow
Black-shouldered Kite
Blackpoll Warbler
Blue Grosbeak (2)
Blue Grouse
Blue-gray Gnatcatcher
Blue-throated Hummingbird
Bobolink (2)
Bohemian Waxwing
Boreal Owl (2)
Botteri's Sparrow (2)
Brewer's Sparrow (7)
Broad-billed Hummingbird
Brown Pelican (California)
Brown-capped Rosy Finch
Brown Creeper
Buff-breasted Flycatcher
Burrowing Owl (8)
Caspian Tern
Cassin's Sparrow (2)
Cassin's Vireo
Chestnut-collared Longspur (3)
Chestnut-backed Chickadee
Chipping Sparrow
Common Yellowthroat (2)
Common Ground Dove
Common Black-Hawk (2)
Common Tern
Cooper's Hawk (2)
Cordilleran Flycatcher (4)
Costa's Hummingbird
Dickcissel
Eastern Bluebird
Elegant Trogon (2)
Elf Owl
Ferruginous Hawk (10)
Ferruginous Pygmy-Owl
Flammulated Owl (2)
Forster's Tern
Franklin's Gull
Gila Woodpecker
Golden-crowned Kinglet (2)
Golden Eagle
Grace's Warbler (4)
Grasshopper Sparrow (4)
Gray Catbird (2)
Gray Flycatcher (6)
Gray Hawk
Gray Vireo (6)
Gray-cheeked Thrush
Greater Pewee
Greater Prairie-Chicken
Green-tailed Towhee
Gyrfalcon
Hammond's Flycatcher (6)
Harlequin Duck
Harris' Hawk
Hermit Warbler
Hooded Oriole
Lark Bunting (3)
Le Conte's Thrasher (2)
Least Flycatcher
Least Tern (4)
Lesser Prairie-Chicken (2)
Lewis' Woodpecker (5)
Lincoln's Sparrow
Loggerhead Shrike (6)
Long-billed Curlew (7)
Long-eared Owl (2)
Lucifer Hummingbird
Lucy's Warbler (4)
MacGillivray's Warbler (7)
Marsh Wren
McCown's Longspur (3)
McKay's Bunting
Montezuma Quail
Mountain Plover (5)
Mountain Bluebird
Northern Beardless-Tyrannulet
Northern Goshawk (6)
Northern Harrier
Northern Shrike
Northern Waterthrush
Northwestern Crow
Olive-sided Flycatcher (11)
Olive Warbler
Orange-crowned Warbler
Orchard Oriole
Osprey
Pacific-slope Flycatcher
Painted Bunting
Peregrine Falcon (3)
Phainopepla
Pileated Woodpecker
Pinyon Jay
Piping Plover (2)
Prairie Falcon
Purple Martin (2)
Red-breasted Sapsucker
Red-eyed Vireo (2)
Red-naped Sapsucker (5)
Red-faced Warbler (2)
Red-headed Woodpecker
Red-shouldered Hawk
Rock Wren
Rufous Hummingbird (3)
Rufous-winged Sparrow
Rusty Blackbird
Sage Grouse (2)
Sage Sparrow (7)
Sage Thrasher (2)
Sandhill Crane (2)
Savannah Sparrow (2)
Scott's Oriole (2)
Sharp-shinned Hawk
Thick-billed Kingbird
Three-toed Woodpecker
Townsend's Warbler (4)
Tree Swallow
Tricolored Blackbird

Trumpeter Swan
Upland Sandpiper (3)
Varied BuntingVaried Thrush (2)
Vaux's Swift (5)
Veery (2)
Virginia's Warbler (6)
Warbling Vireo
Western Bluebird
Western Wood-Pewee
Western Screech-Owl
Whip-poor-will
Whiskered Screech-Owl
White-headed Woodpecker
Vermillion Flycatcher (2)
Violet-crowned Hummingbird (2)

Sharp-tailed Grouse (Columbian)
Short-eared Owl (2)
Siberian Tit
Smith's Longspur
Snowy Plover (4)
Spotted Owl (2)
Sprague's Pipit (2)
Summer Tanager (3)
Swainson's Hawk (2)
Swainson's Thrush

APPENDIX G
ECONOMICS

Figures G-1-G-4, Maps Showing Distribution of Mineral Commodities Across the United States A-293

Table G-1. Gross State Product (GSP) for Study Area 1982, 1990, and 1997 . . . . A-297

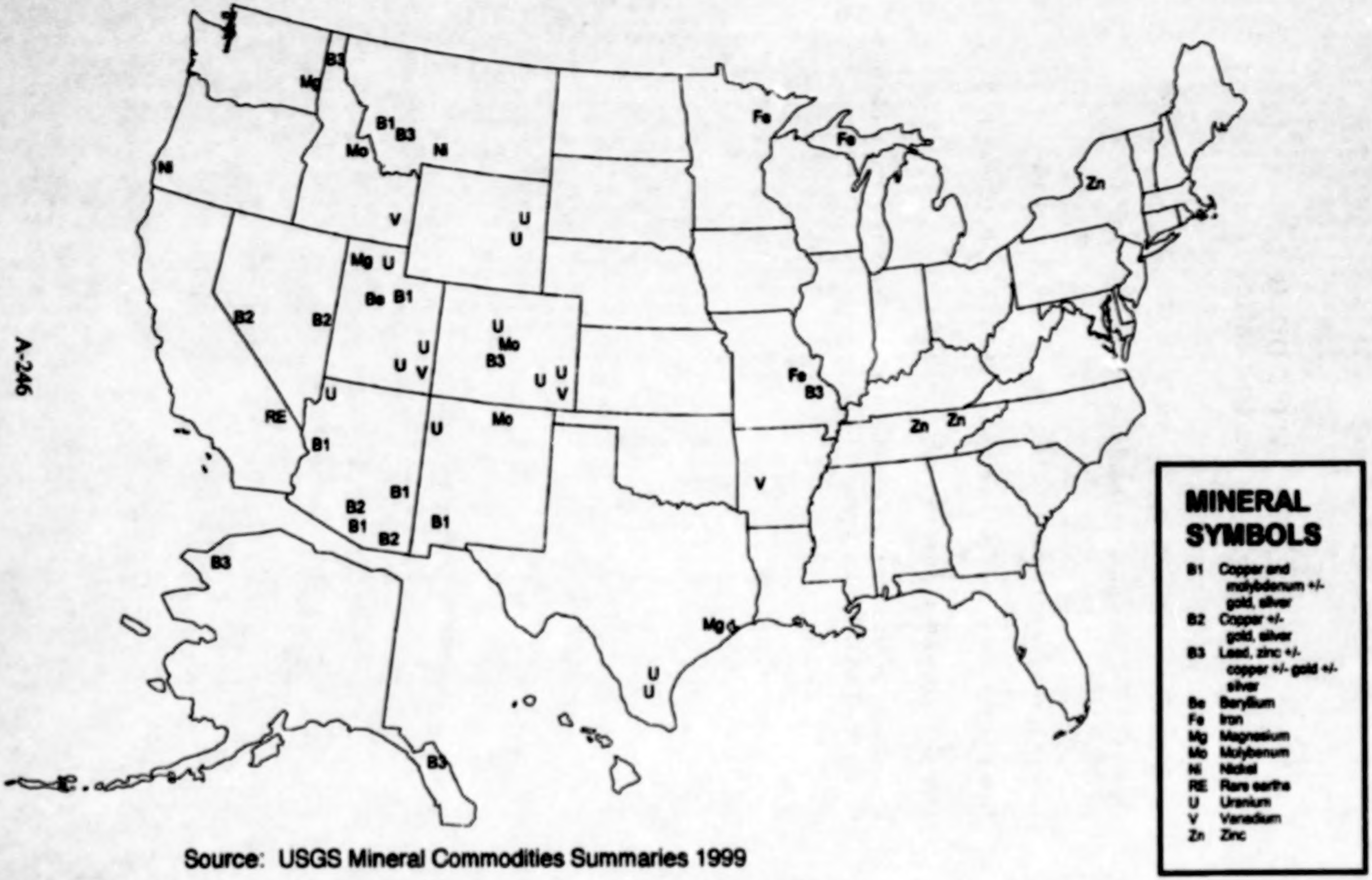
Table G-2. Personal Income and Employment in Study Area, 1980, 1990, 1998 . . . . A-299

Table G-3. Employment Trends in Study Area, 1980-1998 . . . . A-300

Methodology for Estimating the Contribution of Locatable Mineral Production to the Economies of the 12 Western States A-302

Figure G-1

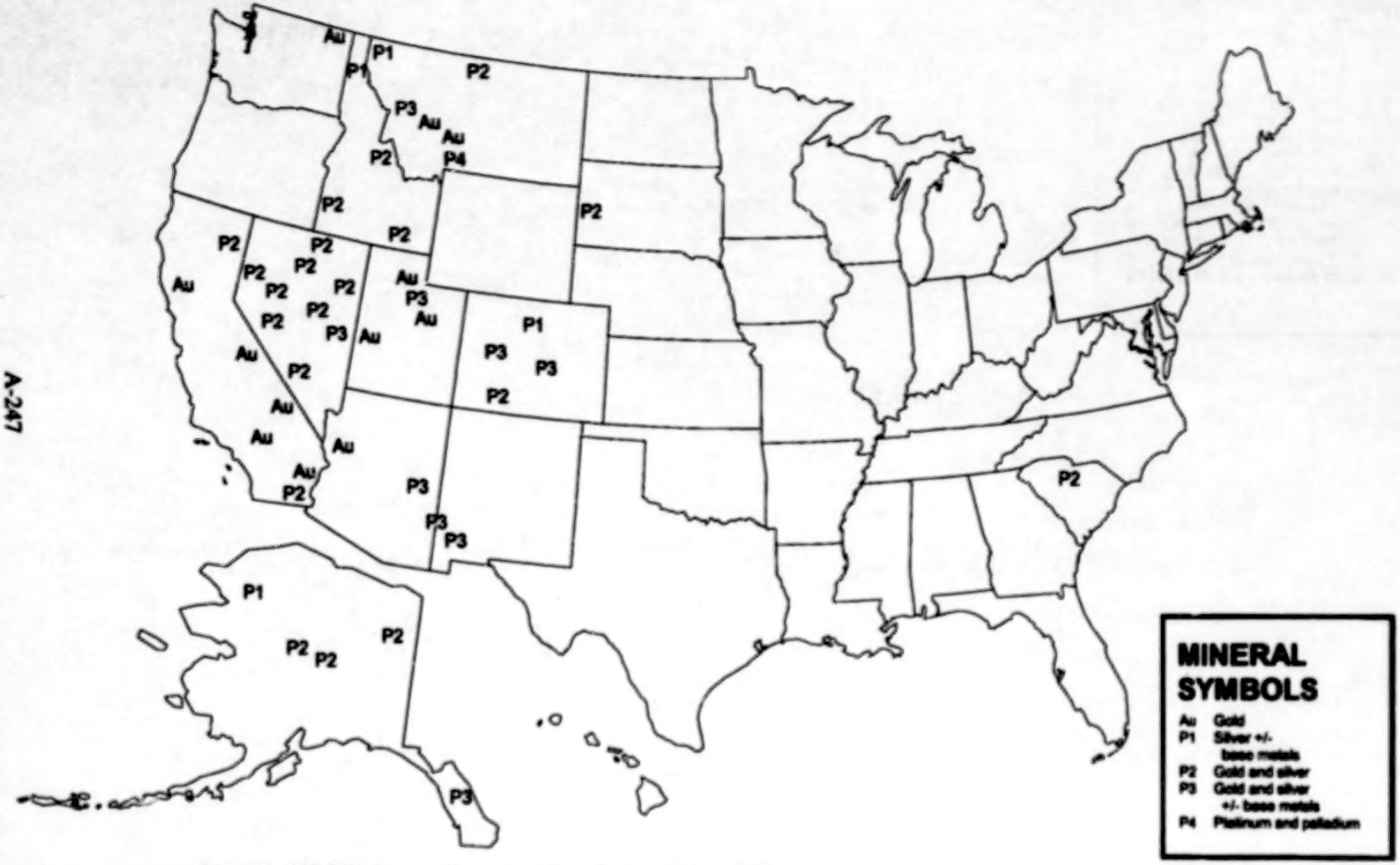
MAJOR BASE AND FERROUS METAL PRODUCING AREAS



Source: USGS Mineral Commodities Summaries 1999

Figure G-2

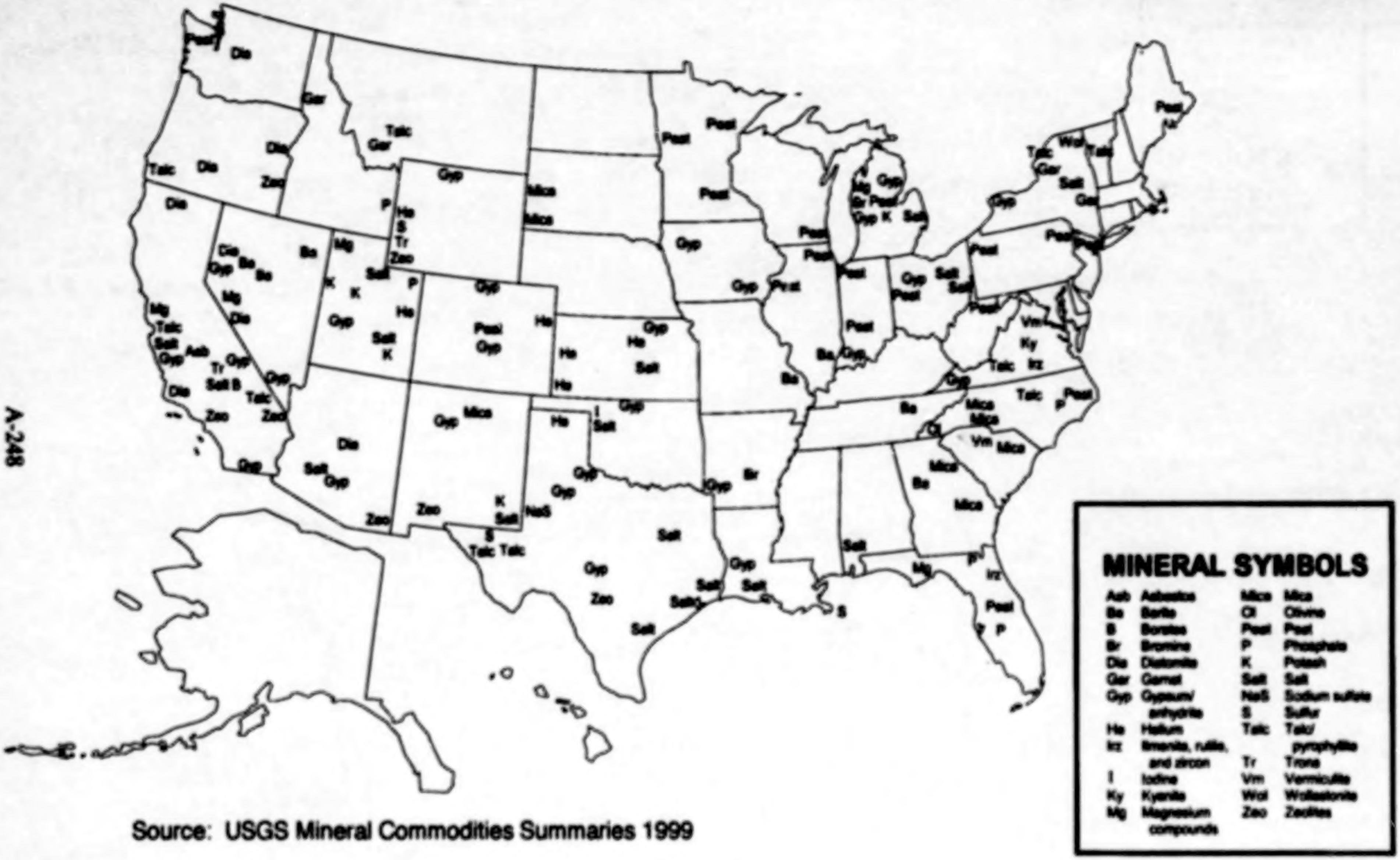
MAJOR PRECIOUS METAL PRODUCING AREAS



Source: USGS Mineral Commodities Summaries 1999

Figure G-3

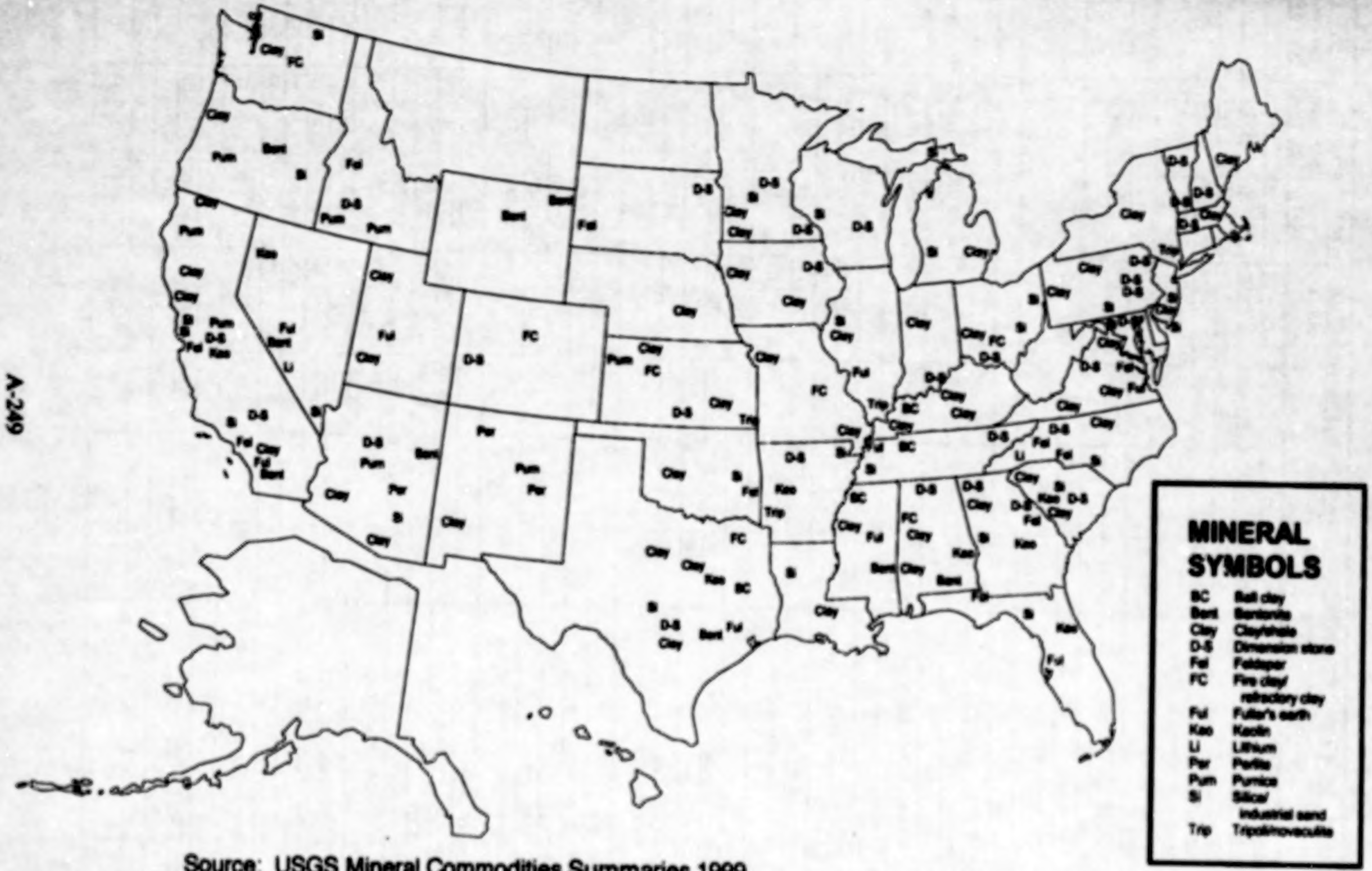
MAJOR INDUSTRIAL ROCK AND MINERAL PRODUCING AREAS - PART I



Source: USGS Mineral Commodities Summaries 1999

Figure G-4

MAJOR INDUSTRIAL ROCK AND MINERAL PRODUCING AREAS - PART II



Source: USGS Mineral Commodities Summaries 1999

Table G-1. Gross State Product (GSP) for Study Area 1982, 1990, and 1997 (millions of 1992 chained dollars)							
State	**1982**	**% of 1982 State Total**	**1990**	**% of 1990 State**	**1997**	**% of 1996 State Total**	**% Change 1982-1997**
Alaska							
Total Gross State Product	$22,900	100.0%	$25,200	100.0%	$21,800	100.0%	-4.8%
Mining	$5,030	22.0%	$7,990	31.7%	$4,390	20.1%	-12.7%
Metal mining	$6	0.0%	$182	0.7%	$314	1.4%	5133.3%
Nonmetallic minerals, except fuels	$7	0.0%	$9	0.0%	$15	0.1%	114.3%
Arizona							
Total Gross State Product	$50,100	100.0%	$72,900	100.0%	$110,000	100.0%	119.6%
Mining	$479	1.0%	$813	1.1%	$1,410	1.3%	194.4%
Metal mining	$405	0.8%	$664	0.9%	$1,110	1.0%	174.1%
Nonmetallic minerals, except fuels	$27	0.1%	$38	0.1%	$90	0.1%	229.3%
California							
Total Gross State Product	$570,000	100.0%	$845,000	100.0%	$928,000	100.0%	62.8%
Mining	$5,400	0.9%	$5,390	0.6%	$5,460	0.6%	1.1%
Metal mining	$65	0.0%	$198	0.0%	$204	0.0%	213.8%
Nonmetallic minerals, except fuels	$378	0.1%	$890	0.1%	$947	0.1%	150.5%
Colorado							
Total Gross State Product	$67,800	100.0%	$79,000	100.0%	$113,000	100.0%	66.7%
Mining	$1,300	1.9%	$1,580	2.0%	$2,490	2.2%	91.5%
Metal mining	$194	0.3%	$83	0.1%	$122	0.1%	-37.1%
Nonmetallic minerals, except fuels	$40	0.1%	$48	0.1%	$114	0.1%	185.0%
Idaho							
Total Gross State Product	$14,700	100.0%	$18,500	100.0%	$27,300	100.0%	85.7%
Mining	$147	1.0%	$198	1.1%	$271	1.0%	84.4%
Metal mining	$78	0.5%	$104	0.6%	$125	0.5%	60.3%
Nonmetallic minerals, except fuels	$63	0.4%	96	0.5%	$146	0.5%	131.7%
Montana							
Total Gross State Product	$13,800	100.0%	$13,900	100.0%	$17,200	100.0%	24.6%
Mining	$750	5.4%	$769	5.5%	$952	5.5%	26.9%
Metal mining	$79	0.6%	$149	1.1%	$210	1.2%	165.8%
Nonmetallic minerals, except fuels	$39	0.3%	$71	0.5%	$77	0.4%	97.4%
Nevada							
Total Gross State Product	$21,000	100.0%	$33,100	100.0%	$50,200	100.0%	139.0%
Mining	$291	1.4%	$1,010	3.1%	$1,650	3.3%	467.0%
Metal mining	$199	0.9%	$893	2.7%	$1,550	3.1%	678.9%
Nonmetallic minerals, except fuels	$93	0.4%	$90	0.3%	$98	0.2%	5.4%
New Mexico							
Total Gross State Product	$25,100	100.0%	$27,900	100.0%	$43,500	100.0%	73.3%
Mining	$2,610	10.4%	$2,480	8.9%	$3,040	7.0%	16.5%
Metal mining	$157	0.6%	$200	0.7%	$209	0.5%	33.1%
Nonmetallic minerals, except fuels	$123	0.5%	$174	0.6%	$247	0.6%	100.8%
Oregon							
Total Gross State Product	$46,500	100.0%	$60,800	100.0%	$90,200	100.0%	94.0%
Mining	$60	0.1%	$88	0.1%	$122	0.1%	103.3%
Metal mining	$5	0.0%	$3	0.0%	$7	0.0%	40.0%
Nonmetallic minerals, except fuels	$42	0.1%	$74	0.1%	$110	0.1%	159.3%

Table G-1. Gross State Product (GSP) for Study Area 1982, 1990, and 1997 (millions of 1992 chained dollars)							
State	1982	% of 1982 State Total	1990	% of 1990 State	1997	% of 1996 State Total	% Change 1982-1997
Utah							
Total Gross State Product	$25,900	100.0%	$32,900	100.0%	$49,600	100.0%	91.5%
Mining	$654	2.5%	$1,300	4.0%	$1,690	3.4%	158.4%
Metal mining	$151	0.6%	$263	0.8%	$665	1.3%	340.4%
Nonmetallic minerals, except fuels	$49	0.2%	$84	0.3%	$66	0.1%	34.7%
Washington							
Total Gross State Product	$90,000	100.0%	$122,000	100.0%	$152,000	100.0%	68.9%
Mining	$115	0.1%	$259	0.2%	$328	0.2%	185.2%
Metal mining	$28	0.0%	$61	0.1%	$51	0.0%	82.1%
Nonmetallic minerals, except fuels	$66	0.1%	$134	0.1%	$193	0.1%	192.4%
Wyoming							
Total Gross State Product	$13,100	100.0%	$13,400	100.0%	$16,500	100.0%	26.0%
Mining	$3,100	23.7%	$4,250	31.7%	$5,310	32.2%	71.3%
Metal mining	$105	0.8%	$24	0.2%	$20	0.1%	-81.0%
Nonmetallic minerals, except fuels	$365	2.8%	$583	4.4%	$834	5.1%	128.5%
Study Area							
Total Gross State Product	$960,900	100.0%	$1,344,800	100.0%	$1,619,300	100.0%	68.5%
Mining	$19,936	2.1%	$26,127	1.9%	$27,113	1.7%	36.0%
Metal mining	$1,472	0.2%	$2,824	0.2%	$4,587	0.3%	211.6%
Nonmetallic minerals, except fuels	$1,292	0.1%	$2,090	0.2%	$2,937	0.2%	127.3%
Metals, nonmetals combined	$2,764	0.3%	$4,914	0.4%	$7,524	0.5%	172.2%
U.S. (GDP)							
Total Gross Domestic Product	$4,620,000	100.0%	$6,140,000	100.0%	$7,270,000	100.0%	57.4%
Mining	$78,800	1.7%	$96,900	1.6%	$110,000	1.5%	39.6%
Metal mining	$2,176	0.0%	$3,664	0.1%	$6,200	0.1%	184.9%
Nonmetallic minerals, except fuels	$5,000	0.1%	$7,755	0.1%	$10,800	0.1%	116.0%
Metals, nonmetals combined	$7,176	0.2%	$11,419	0.2%	$17,000	0.2%	136.9%
Study Area as % of U.S. Total							
Total GSP	20.8%	N/A	21.9%	N/A	22.3%	N/A	7.1%
Mining	25.3%	N/A	27.0%	N/A	24.6%	N/A	-2.6%
Metal mining	67.6%	N/A	77.1%	N/A	74.0%	N/A	9.4%
Nonmetallic minerals, except fuels	25.8%	N/A	27.0%	N/A	27.2%	N/A	5.2%
Metals, nonmetals combined	38.5%	N/A	43.0%	N/A	44.3%	N/A	14.9%
Source: U.S. Department of Commerce, Bureau of Economic Analysis 1998.							

Table G-2: Personal Income, Employment, and Population in Study Area 1980, 1990, 1999

Category	1980	1990	1999
PERSONAL INCOME (million current dollars)			
Total Personal Income			
Study Area Total	$476,000	$1,060,000	$1,610,000
U.S. Total	$2,310,000	$4,890,000	$7,350,000
Study Area as Percent of U.S. Total	20.6%	21.6%	21.9%
Personal Income - Metal Mining			
Study Area Total	$1,920	$1,650	$2,160
U.S. Total	$3,170	$2,430	$2,880
Study Area as Percent of U.S. Total	60.5%	68.1%	74.9%
Personal Income - Nonmetallic Minerals, except fuels			
Study Area Total	$694	$948	$1,170
U.S. Total	$2,680	$4,230	$5,340
Study Area as Percent of U.S. Total	25.9%	22.4%	21.9%
Personal Income - Metals, Nonmetals combined			
Study Area Total	$2,610	$2,600	$3,330
U.S. Total	$5,850	$6,660	$8,230
Study Area as Percent of U.S. Total	44.6%	39.1%	40.4%
EMPLOYMENT (000)			
Total Employment			
Study Area Total	22,300	29,500	34,700
U.S. Total	114,000	139,000	160,000
Study Area as Percent of U.S. Total	19.6%	21.2%	21.7%
Employment - Metal Mining			
Study Area Total	65	42	43
U.S. Total	106	64	58
Study Area as Percent of U.S. Total	61.9%	65.9%	74.0%
Employment - Nonmetallic minerals, except fuels			
Study Area Total	29	24	23
U.S. Total	131	121	118
Study Area as Percent of U.S. Total	21.9%	20.0%	19.8%
Employment - Metals, Nonmetals combined			
Study Area Total	94	66	67
U.S. Total	237	185	177
Study Area as Percent of U.S. Total	39.8%	35.9%	37.8%
POPULATION (000)			
Study Area Total	42,500	52,000	59,100
U.S. Total	227,000	249,000	270,000
Study Area as Percent of U.S. Total	18.7%	20.9%	21.9%

Notes: All figures rounded to three significant digits.
Source: US Department of Commerce, BEA 2000

Table G-3. Employment Trends in Study Area, 1980-1998

State	1980	Percent of 1980 Total	1990	Percent of 1990 Total	1998	Percent of 1998 Total	Percent Change 1980-1998
Alaska							
Total	169,000	100.0%	233,000	100.0%	267,000	100.0%	58.0%
Total Private	115,000	68.0%	165,000	70.8%	199,000	74.5%	73.0%
Mining	6,680	4.0%	11,400	4.9%	10,400	3.9%	55.7%
Metal Mining	320	0.2%	1,080	0.5%	1,260	0.5%	293.8%
Nonmetallic minerals	0	N/A	0	N/A	0	N/A	N/A
Arizona							
Total	1,020,000	100.0%	1,500,000	100.0%	2,070,000	100.0%	102.9%
Total Private	825,000	80.9%	1,240,000	82.7%	1,770,000	85.5%	114.5%
Mining	21,100	2.1%	12,700	0.8%	12,700	0.6%	-39.8%
Metal Mining	19,200	1.9%	10,600	0.7%	10,700	0.5%	-44.3%
Nonmetallic minerals	658	0.1%	855	0.1%	1,050	0.1%	59.6%
California							
Total	10,100,000	100.0%	13,300,000	100.0%	14,000,000	100.0%	38.6%
Total Private	8,400,000	83.2%	11,300,000	85.0%	11,900,000	85.0%	41.7%
Mining	43,300	0.4%	40,100	0.3%	24,800	0.2%	-42.7%
Metal Mining	0	N/A	2,390	0.0%	1,610	0.0%	N/A
Nonmetallic minerals	7,960	0.1%	6,730	0.1%	5,230	0.0%	-34.3%
Colorado							
Total	1,230,000	100.0%	1,500,000	100.0%	2,030,000	100.0%	65.0%
Total Private	996,000	81.0%	1,240,000	82.7%	1,730,000	85.2%	73.7%
Mining	36,000	2.9%	19,800	1.3%	14,000	0.7%	-61.1%
Metal Mining	11,700	1.0%	3,440	0.2%	2,270	0.1%	-80.6%
Nonmetallic minerals	806	0.1%	985	0.1%	1,690	0.1%	109.7%
Idaho							
Total	316,000	100.0%	386,000	100.0%	526,000	100.0%	66.5%
Total Private	250,000	79.1%	309,000	80.1%	431,000	81.9%	72.4%
Mining	4,670	1.5%	3,870	1.0%	0	N/A	N/A
Metal Mining	3,100	1.0%	2,780	0.7%	1,690	0.3%	-45.5%
Nonmetallic minerals	1,400	0.4%	1,110	0.3%	1,190	0.2%	-15.0%
Montana							
Total	265,000	100.0%	287,000	100.0%	365,000	100.0%	37.7%
Total Private	204,000	77.0%	223,000	77.7%	294,000	80.5%	44.1%
Mining	8,850	3.3%	6,280	2.2%	5,160	1.4%	-41.7%
Metal Mining	1,920	0.7%	2,640	0.9%	1,830	0.5%	-4.7%
Nonmetallic minerals	841	0.3%	826	0.3%	800	0.2%	-4.9%
Nevada							
Total	398,000	100.0%	620,000	100.0%	923,000	100.0%	131.9%
Total Private	341,000	85.7%	544,000	87.7%	813,000	88.1%	138.4%
Mining	6,220	1.6%	14,300	2.3%	13,200	1.4%	112.2%
Metal Mining	3,640	0.9%	13,000	2.1%	11,500	1.2%	215.9%
Nonmetallic minerals	1,770	0.4%	1,130	0.2%	1,670	0.2%	-5.7%
New Mexico							
Total	444,000	100.0%	561,000	100.0%	693,000	100.0%	56.1%
Total Private	335,000	75.5%	430,000	76.6%	543,000	78.4%	62.1%
Mining	29,460	6.6%	16,100	2.9%	15,000	2.2%	-49.1%
Metal Mining	10,700	2.4%	2,120	0.4%	2,000	0.3%	-81.3%
Nonmetallic minerals	3,400	0.8%	2,310	0.4%	1,650	0.2%	-51.5%

Table G-3. Employment Trends in Study Area, 1980-1998

State	1980	Percent of 1980 Total	1990	Percent of 1990 Total	1998	Percent of 1998 Total	Percent Change 1980-1998
Oregon							
Total	1,020,000	100.0%	1,240,000	100.0%	1,550,000	100.0%	52.0%
Total Private	824,000	80.8%	1,030,000	83.1%	1,320,000	85.2%	60.2%
Mining	2,280	0.2%	1,530	0.1%	1,810	0.1%	-20.6%
Metal Mining	271	0.0%	106	0.0%	0	N/A	N/A
Nonmetallic minerals	1,620	0.2%	1,300	0.1%	1,770	0.1%	9.3%
Utah							
Total	523,000	100.0%	694,000	100.0%	992,000	100.0%	89.7%
Total Private	407,000	77.8%	553,000	79.7%	827,000	83.4%	103.2%
Mining	18,500	3.5%	0	0.0%	8,040	0.8%	-56.5%
Metal Mining	8,430	1.6%	3,090	0.4%	2,560	0.3%	-69.6%
Nonmetallic minerals	999	0.2%	0	0.0%	1,030	0.1%	3.1%
Washington							
Total	1,600,000	100.0%	2,140,000	100.0%	2,590,000	100.0%	61.9%
Total Private	1,290,000	80.6%	1,760,000	82.2%	2,150,000	83.0%	66.7%
Mining	3,160	0.2%	0	N/A	3,250	0.1%	2.8%
Metal Mining	869	0.1%	963	0.0%	348	0.0%	-60.0%
Nonmetallic minerals	1,580	0.1%	1,650	0.1%	2,320	0.1%	46.8%
Wyoming							
Total	205,000	100.0%	191,000	100.0%	220,000	100.0%	7.3%
Total Private	163,000	79.5%	140,000	73.3%	167,000	75.9%	2.5%
Mining	36,000	17.6%	18,300	9.6%	16,600	7.5%	-53.9%
Metal Mining	6,430	3.1%	760	0.4%	690	0.3%	-89.3%
Nonmetallic minerals	5,690	2.8%	3,920	2.1%	3,130	1.4%	-45.0%
Study Area Total							
Total	17,000,000	100.0%	22,300,000	100.0%	26,226,000	100.0%	54.3%
Total Private	14,000,000	82.4%	18,700,000	83.9%	22,144,000	84.4%	58.2%
Mining	207,000	1.2%	138,200	0.6%	124,960	0.5%	-39.6%
Metal Mining	64,700	0.4%	40,300	0.2%	36,458	0.1%	-43.7%
Nonmetallic minerals	25,900	0.2%	20,000	0.1%	21,530	0.1%	-16.9%
U.S. Total							
Total	89,200,000	100.0%	109,000,000	100.0%	124,000,000	100.0%	39.0%
Total Private	73,400,000	82.3%	90,900,000	83.4%	105,000,000	84.7%	43.1%
Mining	10,400,002	11.7%	711,000	0.7%	588,000	0.5%	-94.3%
Metal Mining	100,000	0.1%	58,900	0.1%	48,800	0.0%	-51.2%
Nonmetallic minerals	124,000	0.1%	112,000	0.1%	110,000	0.1%	-11.3%
Study Area as Percent of U.S.							
Total	19.1%		20.5%		21.2%		
Total Private	19.1%		20.6%		21.1%		
Mining	2.0%		19.4%		21.3%		
Metal Mining	64.7%		68.4%		74.7%		
Nonmetallic minerals	20.9%		17.9%		19.6%		

Notes: Figures rounded to three significant digits. "0" shows data that were withheld to avoid disclosure of proprietary information.
N/A = not applicable.
Source: Bell 2000.

562

METHODOLOGY FOR ESTIMATING THE CONTRIBUTION OF LOCATABLE MINERAL PRODUCTION TO THE ECONOMIES OF THE 12 WESTERN STATES

Introduction

This analysis provides baseline estimates of the regional economic impacts of locatable mineral production in the western United States under current conditions. The estimates are based on estimated values of mine production and use of the U.S. Forest Service IMPLAN (IMpact analysis for PLANning) model. The IMPLAN model estimates the direct, indirect, and induced impacts of an economic activity on a defined region. This appendix presents the following:

- A general overview of regional input-output (I-O) modeling along with limitations of the methodology.
- Some results of previous regional economic analyses for energy and minerals as a basis for comparison with the analysis presented here.
- U.S. Department of Commerce data, which may provide some basis for potentially varying production functions and rates of return for mining operations in various states.

This appendix also estimates the multipliers and regional impacts from production of locatable minerals.

Estimating Regional Impacts

Regional impacts represent the effect, typically measured by the value of total output and income, of an activity on the local economy. Regional impacts can be distinguished by direct effects, indirect effects, and induced effects. Direct effects are represented by changes in the value of production in the original final demand industry. Indirect effects are backward linkages, where production is needed from industries supplying the original industry. These backward linkages can continue for several rounds and provide other economic impacts to the region. Induced effects are changes in regional household spending caused by regional employment changes. These changes in employment and income result from direct and indirect effects. The combination of direct, indirect, and induced effects result in multiplier effects from economic activities within a region.

The IMPLAN model uses the U.S. Department of Commerce national I-O model to estimate the flows of commodities used and produced by industry. The social accounts of the region under consideration are also included in the IMPLAN data base. Social accounts represent the flow of commodities to industry from producers and consumers as well as consumption of the factors of production from outside the region. Social accounts are converted to the input/output accounts and multipliers for each industry. IMPLAN includes tables that account for the percentage of each category's expenditures that remain within the region and expenditures that would flow outside the region.

Assumptions used in the I-O based regional impact models can potentially limit the accuracy of some basic models. The inputs used by every firm and the outputs produced by every firm in an industry are assumed to be used or produced in the same proportions. The assumption of homogeneous production can be a problem if production techniques greatly vary within the same industry.

The level of output for any industry is also assumed to be the only factor that determines input purchase requirements. Changes in the relative prices of inputs that would affect the mix of inputs purchased are not accounted for. Changes in technology are not accounted for unless the production functions are modified over time and the models are rerun after each change. Constant returns to scale are assumed, where production functions are linear, the effects of increased demand are additive, and the distribution of purchases and sales is assumed to be static.

I-O models represent the current relationships among production, technology, market structures, and inter-regional trade. Because these relationships are assumed to be static, substitutions between inputs are not allowed. One major reason that substitution would be expected consists of changes in input prices. If the relative prices for inputs change, input substitution would be expected to occur because a different mix of inputs may become more cost effective. Changes in output prices can also cause substitution effects that would reduce total regional impacts. But substitution is not allowed within the I-O model. In addition, the supply of all inputs required for current and future production is not considered to be a constraint in an I-O model.

In the short run these limitations in the I-O methodology may not create significant problems because of the relatively limited adjustments that can be made in a short time. Input substitutions may not be possible immediately, so price changes may not have a short-run impact on the types of inputs used. In the long run, however, an I-O based analysis may not reliably estimate regional impacts. The longer period of time allows producers to respond to price changes, and technology can change substantially in the long run. These factors allow for greater substitution in the long run and a greater possibility of error in a static I-O based model.

The problems of I-O based analyses may also be minor if the impact region is not large enough to significantly affect the market and, therefore, significantly affect prices of inputs and outputs. A small-market impact results in minor price effects and, therefore, minor substitution effects. If a large region is included in an analysis, price effects are more likely, and the input-output analysis will miss some substitution effects.

Estimating the regional impacts from changes in mineral production using IMPLAN may result in significant errors due to the problems mentioned above. Mining techniques for the same mineral can vary a great deal in different regions, resulting in varied input requirements. Input and output prices in the mineral industry can also fluctuate significantly over a relatively short period. Despite these potential problems, an analysis of mineral extraction impacts using IMPLAN reveals the magnitude of mineral production impacts.

Types of Multipliers

364

Output multipliers translate the impact of changes in final demand spending into changes in output. ***Total industry output*** is the value of sales, in producer prices, from industry production. Final demand reflects the value of all commodities and services purchased for final use. Final demand is equal to the sum of household purchases, government purchases, business investment purchases, exports, and inventory sales. Payments between governmental units are considered transfer payments and are excluded from this measure. Exports include purchases of goods or services that are exported from the region.

Total income multipliers translate the impact of changes in final demand spending into changes in total income. Total income is defined as the sum of changes in employee compensation, proprietary income, and other property income, resulting from a change in final demand. Total income is equal to property income plus employee compensation. Property income includes proprietary income and other property income. Proprietary income can be defined as all income from self-employment, such as income earned by noncorporate business owners, doctors, and lawyers. Other property income includes dividends, interest, royalties, rental income, corporate profits, and corporate transfer payments. ***Employee compensation,*** a subcategory of total income, represents worker income as measured by wages, salaries, benefits, and retirement payments.

Value added multipliers translate the impact of changes in final demand spending into changes in value added. Value added represents income generated by local factors of production and payments to government, including employee compensation, proprietary income, other types of property income, and indirect business taxes. Indirect business taxes are payments to government on production, sales, purchase, or use of goods and services. Indirect business taxes do not include taxes on profit or income.

Employment multipliers are based on the fact that a change in final demand will have direct, indirect, and induced effects that will lead to employment changes. Employment multipliers measure the total change in employment from the production of $1 of output for final demand. Employment is measured by both part- and full-time jobs. Therefore, the number of jobs does not consist of full-time equivalents.

The extent of regional impacts can be measured in IMPLAN by two types of multipliers. Type I multipliers measure the sum of the direct plus indirect effects divided by the direct effects, or Type I multiplier = (Direct + Indirect)/(Direct). Type III multipliers account for induced effects, where: Type III multiplier = (Direct + Indirect + Induced)/(Direct). The induced effects in Type III multipliers are derived from an open model where households are exogenous or "outside" the model. The open model allows the assumption that some household spending occurs outside the region of consideration.

A large multiplier generally means that an industry is closely linked to the local economy. But if the industry is small relative to the size of the local economy, then a big multiplier does not translate into a large stimulus. But a small increase in demand for a sector with a small multiplier can have a significant impact if that industry produces a large proportion of total output of the regional economy. Also, if the direct effect is tiny compared to the calculated indirect and induced effects, then dividing the difect effect into indirect or the sum of indirect and induced effects will result in a large number. In these cases the large multiplier is not meaningful and should be ignored.

The Value of Mineral Production, Costs of Production, and Profits

Current information on the costs of mineral production, profits or value added from production, and the variation from region to region can provide some basis for evaluating the overall importance of locatable minerals in each region and how average production relationships apply to specific regions. The rates of return for mining operations have varied a great deal over the last 10 years. According to the U.S. Department of Commerce, Bureau of the Census, the average rate of return for all mining operations with assets of $50 million or more from the fourth quarter of 1987 to the first quarter of 1996 was 5.05 cents per dollar investment before taxes and 3.54 cents after taxes (Bureau of the Census 1997). The rate of return over the 10-year period has ranged from -7.4 cents to 14.1 cents per dollar after taxes. The rate of return for mineral extraction investment is fairly low, but this does not say that the regional impacts from mineral production are small.

Mineral production requires large amounts of investment, which supports industries providing production inputs. Tables G-4 and G-5 show the value of inputs and value added for mineral industries by state and as a national average from the 1992 Census of Mineral Industries. Although the data are not complete, they do show the relative costs of labor, supplies, and capital for different types of operations. This information is useful for modifying production relationships in the IMPLAN model.

Recent Mineral Impact Studies

A recent study of the U.S. gold industry estimated the regional impacts from gold and silver production at the state level (Dobra 1999). The Dobra study included estimates of the total value of gold and silver production as well as employment, output, and earnings impacts in 1997. The results for states in the study area are presented in Table G-6.

The Dobra study used production estimates provided by individual state geology agencies or the U.S. Geological Survey, London gold and silver prices, and U.S. Bureau of Economic Analysis impact multipliers. The important result of the study is the large regional impacts of gold production in the western states.

Another study of regional impacts of restraints to mineral access in the East Mojave National Scenic Area estimated the potential impacts to industry output, earnings, and employment in San Bernardino County, California, from mine construction and production (Schantz and Adams 1990). The East Mojave study showed impacts of about $1.27 billion from cumulative gold mine revenues of $968 million at the county level. These amounts represent substantial impacts considering the small study area.

Another study, published by the National Mining Association (see Table G-7), estimated the

Ab

economic impact of the solid-minerals mining industry (Leaming 1997). This study, which included minerals such as coal and many nonlocatable types, estimated that the western states generated $115 billion and 1.1 million jobs in 1995. These figures amount to 37% of the $524 billion total U.S. impact of solid-mineral mining and 22% of the estimated 5 million total jobs. The data and methodology used in this study differ substantially from the multiplier analyses described previously, and the figures cannot be compared between the studies. This study, nevertheless, provides a useful comparison of the western mining industry in relation to the national industry as a whole.

A U.S. Forest Service analysis of energy and minerals industries in the United States provided information on the economic contribution of U.S. extractive industries at the state, regional, and national levels (USFS 1996). This study estimated multipliers for metallic ores, including copper, gold, silver, ferroalloy ores, uranium, radium, and other metal ores not classified elsewhere. The study also estimated multipliers for metal mining services, describing in detail mineral industry impacts. This study can be used to help validate the regional economic impacts presented in this analysis. The Forest Service analysis estimated multipliers for 1977, 1982, 1985, and 1990 for the Nation, for each Resource Planning Act region in the United States, and for individual states. State-level multipliers are presented for 1985 and 1990 in Tables G-8 and G-9.

The Forest Service analysis also presented base year statistics that estimate the regional impacts from extraction industries. These results showed significant impacts from mineral and energy industry activities. But the importance of metal mining in the United States appeared to have decreased slightly from 1977 to 1990. The decrease in the importance of metal mining was not universal. Metal mining increased in importance in Nevada from 0.52% of nominal gross state product in 1977 to 6.12% of nominal gross state product in 1990.

Table G-4. Employment, Payroll, Value Added, and Costs of Production for Mining (million $)

State/type of mining	Establishments	Total Employees	Payroll	Value Added by Mining	Cost of Supplies	Capital Expenditures
Alaska						
Lead and zinc ores	2	250-499	-	-	-	-
Gold	41	400	$19.0	$129.4	-	-
Arizona						
Copper ores	28	10,100	384.6	1,429.9	$888.9	$187.2
Gold ores	28	300	11.3	48.1	-	-
Silver ores	1	<199	-	-	-	-
Metal mining services	27	500	15.1	42.2	17.9	5.0
California						
Gold ore	45	2,100	77.3	267.7	-	-
Miscellaneous metal ores	11	250-499	-	-	-	-
Colorado	5	-	-	-	-	-
Lead and zinc ores	52	1,200	88.7	4.8	-	-
Gold ores	1	-	-	-	-	-
Silver ores	20	200	7.0	12.2	4.3	1.2
Metal mining services						
Idaho	5	100-249	-	-	-	-
Lead and zinc ores	25	250-499	-	-	-	-
Gold ores	9	250-499	-	-	-	-
Silver ores	4	250-499	-	-	-	-
Miscellaneous metal ores	3	500-999	-	-	-	-
Montana	21	1000	36.8	160.6	60.9	31.6
Copper ores	16	200	6.3	15.0	-	-
Gold and silver ores	7	250-499	-	-	-	-
Metal mining services						
Miscellaneous metal	119	9,900	455.1	1,718.0	1,096.2	556.1
ores	36	1,100	40.6	106.4	-	-
Nevada						
Gold and silver ores	7	1000-2499	-	-	-	-
Metal mining services						
New Mexico	5	1000-2499	-	-	-	-
Copper ores	23	500	20.2	79.3		-
Utah	22	400	16.4	14.2	-	-
Copper ores	11	100-249	-	-	-	-
Gold and silver ores						
Metal mining services	13	500	23.5	67.2	-	-
Miscellaneous metal ores	14	100	4.9	8.8	-	-
Washington	15	300	$15.3	$14.5	-	-
Gold and silver ores						
Metal mining services						
Wyoming						
Miscellaneous metal ores						

Source: Bureau of the Census 1996a,b.

Table G-5. National Average Costs of Production for Various Minerals, 1992 (million $)

Item	Copper	Gold	Metal Mining Services	Miscellaneous Metal Ores	Silver
Supplemental labor costs	$136.7	$181.2	$29.9	$21.7	$16.7
Purchased fuels consumed	61.4	108.9	16.2	8.8	4.5
Purchased electricity	316.7	143.9	2.2	29.5	4.5
Contract work	113.7	-	-	-	-
Minerals/ores for preparation	208.3	NA	NA	1.6	NA
Purchased machinery	370.5	362.1	13.1	9.5	-
Parts and attachments	146.9	147.1	8.7	13.0	-
Industrial chemicals	104.1	128.3	NA	13.6	-
Explosive materials	37.4	61.6	-	3.2	-
Tires and inner tubes	39.9	39.0	-	0.8	-
Lime	21.8	26.3	-	1.2	-
Iron & steel castings and forgings	79.5	37.1	-	-	-
Steel shapes and forms	43.5	34.9	-	3.7	-
Other supplies	175.5	196.1	23.8	19.6	-
Undistributed	2.5	21.2	23.0	9.8	-
Communication services	1.7	3.3	0.8	0.4	0.1
Value of shipments and receipts	3,374.9	4,340.0	350.4	312.2	114.6
Change in inventories 1991-1992	21.6	18.4	3.2	-14.7	-10.9
New capital expend, buildings	-	538.2	0.4	5.0	-
New capital expend, equipment	385.8	103.8	16.5	14.4	-
Used capital expenditures	8.6	16.4	-	-	0.1
Mineral exploration/development	-	335.3	NA	-	5.0
Rental payments	$18.4	23.6	$6.9	$2.0	-
Lease rents	-	$10.1	NA	-	$0.1

Source: Bureau of the Census 1996c and 1996d.

Table G-6. Impacts of U.S. Gold and Silver Production, 1997 ($000)

State	Total value	Employment (jobs)	Output	Earnings
Alaska	$266,198	3,700	$471,809	$135,841
Arizona	2,876	91	7,051	2,338
California	259,069	4,793	531,300	146,271
Colorado	76,197	2,758	200,786	53,041
Idaho	139,921	3,092	254,167	74,228
Montana	110,384	2,782	223,163	64,508
Nevada	2,722,650	51,730	4,858,025	1,493,101
Utah	$278,910	9,148	$734,231	$217,048

Source: Dobra 1999.

Table G-7. Economic Impact of Solid-Mineral Mining from NMA Study ($000)

State	Total Value of Solid Minerals Produced	Total Economic Impact	Total Employment
Alaska	$589,600	$1,342,600	12,000
Arizona	4,975,800	13,715,900	137,300
California	2,866,100	52,475,900	469,200
Colorado	995,500	7,634,600	77,300
Idaho	383,300	1,898,300	23,600
Montana	1,049,400	2,214,100	24,900
Nevada	3,291,300	7,067,000	63,000
New Mexico	1,775,300	3,409,000	44,000
Oregon	391,600	5,108,300	53,500
Utah	2,417,000	6,907,000	66,200
Washington	730,300	9,604,800	92,300
Wyoming	2,695,500	3,967,400	41,400
12-State Total	22,160,700	115,344,900	1,104,700
U.S. Total	$60,055,000	$523,604,100	4,954,000
Western Region as Percent of U.S.	37%	22%	22%

Source: Leaming 1997.

Multipliers and Regional Impacts from Locatable Mineral Production

The IMPLAN model was used along with estimates of the value of locatable mineral production at the state l
estimate regional impacts. The categories of minerals include gold, silver, copper, and other metals and indu
regional impacts for the "other metals and industrials" category were estimated using the metal mining servic
metals sectors. The types of mining operations in the West greatly vary, and the input requirements can vary
deal. This variation will affect the estimated multipliers. The multipliers estimated using the IMPLAN mode
on national-level production relationships. The multipliers and regional impact analysis can be improved by
the input requirements for different types of operations.

The production function coefficients can be modified in IMPLAN to account for regional production differen
modifications require detailed input requirement data from which production relationships can be estimated.
input requirement data are not available from a cross-section of mining operations at a small regional level. I
of the Census data, such as in Tables G-4 and G-5, can be used to estimate the percentage of total production
attributable to labor and capital expenditures. These percentages, on a statewide basis, can be compared to th
average and used to modify the labor and capital percentages represented in the IMPLAN model.

The U.S. Department of Commerce mining cost data for employee payroll and capital expenditures for each
states and the study area total were compared to the national

570

Table G-8. 1985 Multipliers Derived in the Forest Service Analysis								
State or Region	Output		Total Income		Value Added		Employment	
	Type I	Type III	Type I	Type III	Type I	Type III	Type I	Type III
Alaska								
Metallic Ores	1.26	1.44	1.64	2.06	1.44	1.71	1.27	1.52
Metal mining services	1.23	1.46	1.41	1.87	1.32	1.65	1.14	1.35
Arizona								
Metallic Ores	1.40	1.68	1.69	2.27	1.62	2.13	1.40	1.79
Metal mining services	1.28	1.49	1.53	1.99	1.29	1.54	1.39	1.78
Idaho								
Metallic Ores	1.24	1.61	1.34	1.89	1.32	1.85	1.26	1.82
Metal mining services	1.22	1.63	1.30	1.88	1.27	1.82	1.21	1.74
Montana								
Metallic Ores	1.45	2.10	2.09	3.95	1.66	2.72	1.47	2.50
Metal mining services	1.34	1.93	1.61	2.75	1.40	2.12	1.38	2.36
Nevada								
Metallic Ores	1.47	2.01	1.77	2.77	1.76	2.74	1.49	2.24
Metal mining services	1.36	1.89	1.43	2.11	1.44	2.12	1.36	2.05
New Mexico								
Metallic Ores	1.43	1.86	1.65	2.38	1.56	2.19	1.45	2.16
Metal mining services	1.39	2.02	1.83	3.24	1.50	2.36	1.27	1.89
Utah								
Metallic Ores	1.46	1.81	1.75	2.41	1.65	2.21	1.48	2.06
Metal mining services	1.31	1.61	1.47	1.94	1.33	1.65	1.41	1.96
Wyoming								
Metallic Ores	1.28	1.56	1.52	2.07	1.36	1.74	1.25	1.68
Metal mining services	1.24	1.47	1.39	1.76	1.27	1.53	1.27	1.71
Pacific Region (CA, OR, WA)								
Metallic Ores	1.58	2.31	2.08	4.32	1.99	4.05	1.39	2.34
Source: USFS 1996.								

Table G-8. 1990 Multipliers Derived in the Forest Service Analysis

State or Region	Output		Total Income		Value Added		Employment	
	Type I	Type III	Type I	Type III	Type I	Type III	Type I	Type III
Alaska								
Metallic Ores	1.16	1.22	1.22	1.31	1.19	1.26	1.39	1.70
Metal mining services	1.14	1.25	1.18	1.35	1.14	1.27	1.15	1.40
Arizona								
Metallic Ores	1.54	1.76	2.43	3.24	2.48	3.36	2.50	3.85
Metal mining services	1.27	1.67	1.29	1.77	1.28	1.75	1.30	2.02
Idaho								
Metallic Ores	1.33	1.56	1.47	1.80	1.46	1.78	1.92	3.00
Metal mining services	1.27	1.64	1.31	1.74	1.29	1.70	1.37	2.17
Montana								
Metallic Ores	1.40	1.67	1.61	2.08	1.55	1.96	2.00	3.31
Metal mining services	1.26	1.63	1.30	1.77	1.25	1.63	1.37	2.28
Nevada								
Metallic Ores	1.37	1.62	1.49	1.82	1.50	1.85	1.82	2.69
Metal mining services	1.32	1.70	1.36	1.81	1.36	1.82	1.34	1.99
New Mexico								
Metallic Ores	1.56	1.78	2.35	3.06	2.29	2.99	2.56	4.07
Metal mining services	1.33	1.77	1.38	1.94	1.34	1.86	1.34	2.15
Utah								
Metallic Ores	1.55	1.77	2.18	2.78	2.15	2.74	2.52	3.84
Metal mining services	1.30	1.66	1.32	1.73	1.30	1.67	1.36	2.10
Wyoming								
Metallic Ores	1.19	1.37	1.19	1.40	1.18	1.36	1.25	1.72
Metal mining services	1.20	1.38	1.20	1.41	1.18	1.37	1.24	1.71
Pacific Region (CA, OR, WA)								
Metallic Ores	1.45	1.88	1.57	2.14	1.59	2.19	1.97	3.43

Source: USFS 1996.

average. These percentages were then applied to the national average employee compensation and capital equipment categories included in the IMPLAN model. The new coefficients were then applied to the individual states. In most cases the differences were less than a 10% change in the coefficient, but the change was important enough to merit the modification.

Although this method for modifying the production functions is not precise, it does attempt to account for regional differences in mineral production. Any evaluation of surface mining regulation alternatives will use a consistent methodology so the economic impacts of the alternatives can be compared on an equal basis. The multipliers for locatable minerals in the study area are presented by state and type of mineral in Table G-10.

The regional impacts from locatable mineral production are based on the estimated value of production adjusted for the local level of activity using IMPLAN local purchase coefficients (LPCs). These LPCs show the percentage of regional demand that can be met by local sources and represent the proportion of activity that occurs in the model region. Using the LPCs better represents the true impact of the mining on the region because the need for some imports is recognized. Assuming all regional demand can be met locally would overstate the regional economic impacts.

The mineral production values used to estimate the regional impacts are presented in Table G-11. These figures represent the portion of mine production of locatable minerals estimated to originate only from public lands in the study area.

The estimated regional impacts from the production of locatable minerals on public lands in the study area are presented in Table G-12. The impacts presented here are based on average production relationships at the national level. Therefore, the estimates are representative of the magnitude of the impacts rather than precise estimates.

The study-area total listed in Table G-12 is not a summation of the impacts estimated for each state. The study area represents a separate IMPLAN impact area. The expenditure and income leakages from the aggregate 12-state area would not be the same as the sum of leakages for each state. Since the larger area would be expected to have relatively small leakages, the overall economic impact of mineral production from a 12-state perspective would be expected to be larger than shown by the individual states.

In comparison, Table G-13 shows the regional economic impacts of all locatable-type mineral production in the study area regardless of land ownership (i.e. including production originating from federal, state, and private lands).

Tables G-14 through G-16 show the regional economic impacts by alternative for Alternatives 2, 3, 4, and 5. See the Economics section in Chapter 3 for an explanation of these impacts.

J23

Table G-10. Estimated 1994 Multipliers

State or Region	Output		Total Income		Value Added		Employment	
	Type I	Type III	Type I	Type III	Type I	Type III	Type I	Type III
Alaska								
Gold	1.32	1.45	1.40	1.60	1.35	1.53	1.63	2.13
Silver	1.10	1.37	1.09	1.35	1.07	1.28	1.08	1.43
Other	1.12	1.25	1.13	1.30	1.12	1.26	1.19	1.56
Arizona								
Gold	1.34	1.62	1.39	1.77	1.37	1.71	1.68	2.64
Silver	1.00	1.57	1.00	1.42	1.00	1.36	1.00	1.59
Copper	1.29	1.58	1.31	1.63	1.30	1.60	1.62	2.55
Other	1.19	1.66	1.23	1.89	1.21	1.79	1.16	1.85
California								
Gold	1.37	1.70	1.36	1.71	1.36	1.73	1.58	2.51
Silver	1.10	1.86	1.07	1.63	1.07	1.61	1.05	1.69
Copper	1.30	1.68	1.27	1.64	1.28	1.66	1.39	2.21
Other	1.10	1.37	1.08	1.29	1.08	1.30	1.17	1.86
Colorado								
Gold	1.43	1.67	1.46	1.74	1.43	1.68	2.14	3.41
Silver	1.12	1.76	1.09	1.62	1.08	1.52	1.07	1.74
Copper	1.36	1.60	1.36	1.60	1.34	1.57	1.96	3.13
Other	1.15	1.37	1.13	1.34	1.12	1.31	1.31	2.09
Idaho								
Gold	1.29	1.50	1.27	1.47	1.26	1.47	1.63	2.54
Silver	1.21	1.62	1.20	1.64	1.17	1.55	1.23	1.95
Copper	1.20	1.40	1.17	1.34	1.17	1.35	1.50	2.34
Other	1.17	1.57	1.14	1.49	1.13	1.46	1.19	1.88
Montana								
Gold	1.37	1.57	1.37	1.61	1.33	1.54	1.83	2.93
Silver	1.11	1.25	1.09	1.23	1.07	1.16	1.27	2.03
Copper	1.31	1.53	1.28	1.51	1.27	1.48	1.61	2.58
Other	1.11	1.29	1.08	1.26	1.07	1.22	1.22	1.94

574

Table G-10. Estimated 1994 Multipliers (cont.)

State or Region	Output		Total Income		Value Added		Employment	
	Type I	Type III	Type I	Type III	Type I	Type III	Type I	Type III
Gold	1.14	1.60	1.48	1.73	1.47	1.74	1.75	2.42
Silver	1.04	1.39	1.03	1.26	1.03	1.26	1.03	1.45
Copper	1.37	1.63	1.43	1.76	1.44	1.79	1.48	2.08
Other	1.01	1.28	1.01	1.17	1.01	1.18	1.01	1.42
New Mexico								
Gold	1.52	1.71	1.77	2.15	1.58	1.84	2.98	4.65
Silver	1.24	1.46	1.29	1.62	1.18	1.38	1.49	2.33
Copper	150	1.79	1.78	2.31	1.65	2.09	1.94	3.02
Other	1.24	1.62	1.36	2.03	1.27	1.78	1.25	1.98
Oregon								
Gold	1.11	1.37	1.08	1.28	1.08	1.27	1.20	1.98
Copper	1.07	1.30	1.05	1.20	1.05	1.20	1.14	1.89
Other	1.20	1.71	1.26	1.96	1.22	1.82	1.19	1.99
Utah								
Gold	1.40	1.64	1.53	1.90	1.46	1.77	2.04	3.17
Silver	1.15	1.44	1.12	1.40	1.09	1.31	1.19	1.85
Copper	1.38	1.63	1.46	1.82	1.42	1.75	1.83	2.85
Other	1.20	1.45	1.22	1.53	1.19	1.46	1.34	2.08
Washington								
Gold	1.24	1.47	1.20	1.39	1.20	1.40	1.51	2.43
Silver	1.09	1.55	1.06	1.41	1.06	1.37	1.08	1.77
Copper	1.20	1.48	1.15	1.36	1.15	1.38	1.32	2.13
Other	1.05	1.50	1.03	1.32	1.03	1.32	1.04	1.71
Wyoming								
Other	1.18	1.32	1.25	1.46	1.20	1.36	1.49	2.15
12-State Total								
Gold	1.59	1.97	1.70	2.22	1.68	2.19	2.11	3.44
Silver	1.11	1.67	1.07	1.49	1.07	1.45	1.08	1.80
Copper	1.49	1.87	1.58	2.09	1.53	2.00	1.84	3.00
Other	1.19	1.50	1.19	1.54	1.17	1.47	1.32	2.15

Source: USFS 1996.

Table G-11. Value of Locatable Mineral Production Originating from Federal Lands 1988 ($000)

Portion of study-area production originating from public lands[1]	43.4%	36.2%	1.0%	2.4%	N/A
State	**Gold**	**Silver**	**Copper**	**Other Metals and Industrials**	**Total**
Alaska	$75,500	$26,600	$0	$16,100	$118,000
Arizona	7,350	12,800	20,600	9,143	49,900
California	76,800	673	0	19,600	97,100
Colorado	31,700	825	0	7,460	40,000
Idaho	23,000	26,500	0	5,830	55,300
Montana	33,800	4,560	820	6,710	45,900
Nevada	1,120,000	39,800	1,170	4,920	1,170,000
New Mexico	11,700	1,200	4,380	8,290	25,600
Oregon	0	0	0	2,010	2,010
Utah	47,700	6,910	4,880	10,800	70,300
Washington	14,600	37	0	3,730	18,300
Wyoming	0	0	0	5,240	5,240
Study-Area Total	1,440,000	120,000	31,900	99,800	1,700,000
U.S. Total (all land types)	$3,480,000	$339,000	$3,220,000	$8,920,000	$16,000,000
Federal Land Portion as Percent of U.S. Total	42%	35%	1%	1%	11%

[1] Source: USDI 1993.

N/A = not applicable. Figures rounded to three significant digits. Some totals may reflect rounding errors.

Note: Includes all production from federal lands, not just production from BLM-administered lands.

576

Table G-12. Estimated Regional Impacts from Production of Locatable Minerals on Public Lands 1998 ($000)

State	Total Industry Output	Personal Income		Value Added	Employment (jobs)
		Total	Employee Compensation		
Alaska	$143,800	$65,900	$30,500	$83,800	970
Arizona	40,600	20,500	12,200	24,100	320
California	142,400	76,500	46,500	83,800	1,020
Colorado	57,600	28,400	16,300	33,800	350
Idaho	69,400	33,300	20,700	41,800	680
Montana	61,700	29,300	18,200	37,600	410
Nevada	1,806,700	629,500	486,300	907,600	10,740
New Mexico	32,000	12,000	5,500	16,600	220
Oregon	1,250	500	900	1,000	10
Utah	14,820	20,900	11,100	25,700	360
Washington	19,900	11,900	7,600	13,300	130
Wyoming	3,500	1,800	900	2,500	30
12-State Area	$3,076,800	$1,390,500	$786,000	$1,588,400	21,31

Note: These estimates include only production estimated to originate from federal lands.
Source: IMPLAN Input-Output Modeling System.

Table G-13: Estimated Regional Impacts from Production of Locatable Minerals 1998–All Land Ownerships ($000)

State	Total Industry Output	Personal Income		Value Added	Employment (jobs)
		Total	Employee Compensation		
Alaska	$757,200	$428,700	$201,400	$540,300	6,800
Arizona	3,401,700	1,688,500	998,700	1,965,400	25,600
California	849,400	557,900	327,000	614,600	8,600
Colorado	328,500	203,000	12,000	242,000	2,600
Idaho	346,800	185,600	96,100	219,700	3,900
Montana	430,400	235,300	141,300	301,600	3,500
Nevada	4,347,800	2,044,800	1,158,500	2,236,300	26,400
New Mexico	862,000	346,300	165,900	458,700	7,400
Oregon	52,900	38,500	22,300	43,100	350
Utah	1,163,300	540,700	286,700	653,700	9,400
Washington	127,200	85,500	51,700	97,700	1,200
Wyoming	147,100	75,600	36,800	103,200	1,350
Study Area	$15,672,800	$7,778,300	$4,358,500	$9,006,000	118,750

BLANK

PAGE

Table G-14. Alternative 2 (State Management) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$118,000	$124,000	$144,000	$151,000	$65,900	$69,200	$30,500	$32,000	$83,800	$88,000	970	1,020
Arizona	49,900	52,300	40,600	42,600	20,500	21,500	12,200	12,800	24,100	25,300	320	340
California	97,100	102,000	142,000	150,000	78,500	80,300	46,500	48,800	83,800	88,000	1,020	1,070
Colorado	40,000	42,000	57,800	60,500	28,400	29,800	16,300	17,100	33,800	35,500	350	370
Idaho	55,300	58,100	69,400	72,900	35,300	37,100	20,700	21,700	41,800	43,900	680	710
Montana	45,900	48,200	61,700	64,800	29,300	30,800	18,200	19,100	37,600	39,500	410	430
Nevada	1,170,000	1,230,000	1,810,000	1,900,000	830,000	871,000	466,000	490,000	908,000	953,300	10,740	11,280
New Mexico	25,600	26,900	32,000	33,600	12,000	12,600	5,500	5,780	16,600	17,400	220	230
Oregon	2,010	2,110	1,250	1,310	500	525	900	945	1,000	1,050	10	11
Utah	70,300	73,800	49,200	51,700	20,900	21,900	11,100	11,700	25,700	27,000	360	380
Washington	18,300	19,300	19,800	20,800	11,900	12,500	7,600	7,980	13,300	14,000	130	140
Wyoming	5,240	5,510	3,500	3,680	1,800	1,890	900	945	2,500	2,630	30	30
Study-Area Total	$1,700,000	$1,780,000	$3,080,000	$3,230,000	$1,390,000	$1,460,000	$796,000	$804,000	$1,590,000	$1,670,000	21,310	22,380

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$0	$5,910	$0	$7,190	$0	$3,300	$0	$1,530	$0	$4,190	0	50
Arizona	0	2,490	0	2,030	0	1,030	0	610	0	1,210	0	16
California	0	4,850	0	7,120	0	3,830	0	2,330	0	4,190	0	50
Colorado	0	2,000	0	2,880	0	1,420	0	815	0	1,690	0	18
Idaho	0	2,770	0	3,470	0	1,770	0	1,040	0	2,090	0	30
Montana	0	2,300	0	3,090	0	1,470	0	910	0	1,880	0	21
Nevada	0	58,500	0	90,400	0	41,500	0	23,300	0	45,400	0	540
New Mexico	0	1,280	0	1,600	0	600	0	275	0	830	0	11
Oregon	0	101	0	63	0	25	0	45	0	50	0	1
Utah	0	3,520	0	2,460	0	1,050	0	555	0	1,290	0	18
Washington	0	917	0	995	0	595	0	380	0	665	0	7
Wyoming	0	262	0	175	0	90	0	45	0	125	0	2
Study Area Total	$0	84,900	$0	$154,000	$0	$69,500	$0	$38,300	$0	$79,400	0	1,070

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 10, except figures under 25. Source: IMPLAN Input-Output Modelling System.

Table G-15. Alternative 3 (Proposed Action) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$106,000	$94,600	$129,000	$115,000	$59,300	$52,700	$27,500	$24,400	$75,400	$87,000	870	780
Arizona	44,900	34,900	36,500	28,400	18,500	14,400	11,000	8,540	21,700	16,900	290	220
California	87,400	72,800	128,000	107,000	68,900	57,400	41,900	34,900	75,400	62,900	920	770
Colorado	36,000	28,000	51,800	40,300	25,500	19,900	14,700	11,400	30,400	23,700	320	250
Idaho	49,800	44,300	62,500	55,500	31,800	28,200	18,600	16,600	37,600	33,400	610	540
Montana	41,300	32,100	55,500	43,200	26,400	20,500	16,400	12,700	33,800	26,300	370	290
Nevada	1,050,000	819,000	1,630,000	1,270,000	747,000	581,000	420,000	326,000	817,000	635,000	9,670	7,520
New Mexico	23,000	17,900	28,800	22,400	10,800	8,400	4,950	3,850	14,900	11,600	200	150
Oregon	1,910	1,710	1,190	1,060	475	425	855	765	950	850	10	9
Utah	63,300	49,200	44,300	34,400	18,800	14,600	9,980	7,770	23,100	18,000	320	250
Washington	17,400	14,700	18,900	15,900	11,300	9,520	7,220	6,080	12,600	10,600	120	100
Wyoming	4,980	4,460	3,330	2,980	1,710	1,530	855	765	2,380	2,130	30	30
Study-Area Total	$1,530,000	$1,210,000	$2,770,000	$2,200,000	$1,250,000	$994,000	$690,000	$548,000	$1,430,000	$1,140,000	19,200	15,240

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	($11,800)	($23,600)	($14,400)	($28,800)	($6,950)	($13,200)	($3,050)	($6,100)	($8,380)	($16,800)	(100)	(190)
Arizona	(5,000)	(15,000)	(4,060)	(12,200)	(2,050)	(6,150)	(1,220)	(3,660)	(2,410)	(7,230)	(30)	(100)
California	(9,710)	(24,300)	(14,200)	(35,600)	(7,650)	(19,100)	(4,650)	(11,600)	(8,380)	(21,000)	(100)	(260)
Colorado	(4,000)	(12,000)	(5,760)	(17,300)	(2,840)	(8,520)	(1,630)	(4,890)	(3,380)	(10,100)	(40)	(110)
Idaho	(5,530)	(11,100)	(6,940)	(13,900)	(3,530)	(7,060)	(2,070)	(4,140)	(4,180)	(8,360)	(70)	(140)
Montana	(4,590)	(13,800)	(6,170)	(18,500)	(2,930)	(8,790)	(1,820)	(5,460)	(3,760)	(11,300)	(40)	(120)
Nevada	(117,000)	(351,000)	(181,000)	(543,000)	(83,000)	(249,000)	(46,600)	(140,000)	(90,800)	(272,000)	(1,070)	(3,220)
New Mexico	(2,560)	(7,670)	(3,200)	(9,600)	(1,200)	(3,600)	(550)	(1,650)	(1,660)	(4,980)	(22)	(70)
Oregon	(101)	(302)	(63)	(188)	(25)	(75)	(45)	(135)	(50)	(150)	(1)	(2)
Utah	(7,040)	(21,100)	(4,920)	(14,800)	(2,090)	(6,270)	(1,110)	(3,330)	(2,570)	(7,710)	(40)	(110)
Washington	(917)	(3,670)	(995)	(3,990)	(595)	(2,380)	(380)	(1,520)	(665)	(2,660)	(7)	(30)
Wyoming	(262)	(787)	(175)	(525)	(90)	(270)	(45)	(135)	(125)	(375)	(2)	(5)
Study Area Total	($169,000)	($484,000)	($305,000)	($877,000)	($138,000)	($386,000)	($75,800)	($218,000)	($157,000)	($453,000)	(2,110)	(6,070)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 10, except figures under 25. Source: IMPLAN Input-Output Modelling System.

Table G-18. Alternative 4 (Maximum Protection) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$94,600	$82,700	$115,000	$101,000	$52,700	$46,100	$24,400	$21,400	$67,000	$58,700	780	680
Arizona	24,800	12,500	20,300	10,200	10,300	5,130	6,100	3,050	12,100	6,030	160	80
California	68,000	48,500	99,700	71,200	53,600	38,300	32,600	23,300	58,700	41,900	710	510
Colorado	20,000	9,990	28,800	14,400	14,200	7,100	8,150	4,080	16,900	8,450	180	90
Idaho	41,500	33,200	52,000	41,600	26,500	21,200	15,500	12,400	31,400	25,100	510	410
Montana	22,900	11,500	30,900	15,400	14,700	7,330	9,100	4,550	18,800	9,400	210	100
Nevada	585,000	292,000	904,000	452,000	415,000	207,000	233,000	117,000	454,000	227,000	5,370	2,680
New Mexico	12,800	6,390	16,000	8,000	6,000	3,000	2,750	1,380	8,300	4,150	110	60
Oregon	1,810	1,610	1,130	1,000	450	400	810	720	900	800	9	8
Utah	35,200	17,600	24,600	12,300	10,500	5,230	5,550	2,780	12,900	6,430	180	90
Washington	13,800	11,000	14,900	11,900	8,930	7,140	5,700	4,560	9,960	7,960	100	80
Wyoming	4,720	4,200	3,150	2,800	1,620	1,440	810	720	2,250	2,000	30	24
Study-Area Total	$925,000	$532,000	$1,680,000	$953,000	$758,000	$435,000	$417,000	$240,000	$866,000	$497,000	11,610	6,670

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	($23,600)	($35,500)	($28,800)	($43,100)	($13,200)	($19,800)	($6,100)	($9,150)	($16,800)	($25,100)	(180)	(290)
Arizona	([illegible],800)	(37,400)	(20,300)	(30,500)	(10,300)	(15,400)	(6,100)	(9,150)	(12,100)	(18,100)	(160)	(240)
California	(29,100)	(48,500)	(42,700)	(71,200)	(23,000)	(38,300)	(14,000)	(23,300)	(25,100)	(41,900)	(310)	(510)
Colorado	(20,000)	(30,000)	(28,800)	(43,200)	(14,200)	(21,300)	(8,150)	(12,200)	(16,[illegible])	(25,400)	(180)	(280)
Idaho	(13,800)	(22,100)	(17,400)	(27,800)	(8,830)	(14,100)	(5,180)	(8,280)	(10,500)	(16,700)	(170)	(270)
Montana	(22,900)	(34,400)	(30,900)	(46,300)	(14,700)	(22,000)	(9,100)	(13,700)	(18,800)	(28,200)	(210)	(310)
Nevada	(585,000)	(877,000)	(904,000)	(1,360,000)	(415,000)	(622,000)	(233,000)	(350,000)	(454,000)	(681,000)	(5,370)	(8,060)
New Mexico	(12,800)	(19,200)	(16,000)	(24,000)	(6,000)	(9,000)	(2,750)	(4,130)	(8,300)	(12,500)	(110)	(170)
Oregon	(201)	(402)	(125)	(250)	(50)	(100)	(90)	(180)	(100)	(200)	(1)	(2)
Utah	(35,200)	(52,800)	(24,600)	(36,900)	(10,500)	(15,700)	(5,550)	(8,330)	(12,900)	(19,300)	(180)	(270)
Washington	(4,590)	(7,340)	(4,975)	(7,960)	(2,980)	(4,760)	(1,900)	(3,040)	(3,330)	(5,320)	(30)	(50)
Wyoming	(524)	(1,050)	(350)	(700)	(180)	(360)	(90)	(180)	(250)	(500)	(3)	(6)
Study Area Total	($773,000)	($1,170,000)	($1,400,000)	($2,110,000)	($633,000)	($955,000)	($349,000)	($526,000)	($723,000)	($1,090,000)	(9,700)	(14,600)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 10, except figures under 25. Source: IMPLAN Input-Output Modelling System.

Table G-17. Alternative 5 (NRC Recommendations) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	$112,000	$106,000	$137,000	$129,000	$62,800	$59,300	$29,000	$27,500	$79,600	$75,400	920	870
Arizona	48,900	47,400	40,600	38,600	20,500	19,500	12,200	11,600	24,100	22,800	320	300
California	92,200	87,400	135,000	128,000	72,700	68,900	44,200	41,800	79,600	75,400	870	820
Colorado	40,000	38,000	57,600	54,700	28,400	27,000	16,300	15,500	33,800	32,100	350	330
Idaho	55,300	49,800	69,400	62,500	35,300	31,800	20,700	18,600	41,800	37,600	680	610
Montana	45,900	43,600	61,700	58,600	29,300	27,800	18,200	17,300	37,600	35,700	410	380
Nevada	1,170,000	1,110,000	1,810,000	1,720,000	830,000	788,000	466,000	443,000	908,000	862,000	10,700	10,200
New Mexico	25,600	24,300	32,000	30,400	12,000	11,400	5,500	5,230	16,800	15,[illegible]	220	210
Oregon	1,810	1,810	1,190	1,130	475	450	855	810	950	[illegible]	10	9
Utah	70,300	66,800	49,200	46,700	20,800	19,800	11,100	10,500	25,700	24,400	380	340
Washington	17,400	16,500	18,800	17,900	11,300	10,700	7,220	6,840	12,600	12,000	120	120
Wyoming	4,980	4,720	3,330	3,150	1,710	1,620	855	810	2,380	2,250	30	30
Study-Area Total	$1,680,000	$1,600,000	$3,060,000	$2,990,000	$1,380,000	$1,310,000	$761,000	$721,000	$1,580,000	$1,490,000	21,160	20,050

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value Added		Number of Jobs	
					Total		Employee Compensation					
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Alaska	($5,910)	($11,800)	($7,180)	($14,400)	($3,300)	($6,580)	($1,530)	($3,050)	(4,180)	($8,380)	(50)	(100)
Arizona	0	(2,480)	0	(2,030)	0	(1,030)	0	(610)	0	(1,210)	0	(16)
California	(4,850)	(9,710)	(7,120)	(14,200)	(3,830)	(7,650)	(2,330)	(4,650)	(4,180)	(3,380)	(50)	(100)
Colorado	0	(2,000)	0	(2,880)	0	(1,420)	0	(615)	0	(1,690)	0	(18)
Idaho	0	(5,530)	0	(6,940)	0	(3,530)	0	(2,070)	0	(4,180)	0	(70)
Montana	0	(2,300)	0	(3,090)	0	(1,470)	0	(910)	0	(1,840)	0	(21)
Nevada	0	(58,500)	0	(80,400)	0	(41,500)	0	(23,300)	0	(45,400)	0	(540)
New Mexico	0	(1,280)	0	(1,800)	0	(600)	0	(275)	0	(530)	0	(11)
Oregon	(101)	(201)	(63)	(125)	(25)	(50)	(45)	(90)	(50)	(100)	(1)	(1)
Utah	0	(3,520)	0	(2,460)	0	(1,050)	0	(555)	0	(1,290)	0	(18)
Washington	(917)	(1,840)	(995)	(1,990)	(595)	(1,190)	(380)	(760)	(665)	(1,330)	(7)	(13)
Wyoming	(262)	(524)	(175)	(350)	(90)	(180)	(45)	(90)	(125)	(250)	(2)	(3)
Study Area Total	($12,000)	($79,700)	($21,500)	($182,000)	($8,730)	($82,000)	($5,360)	($45,200)	($11,100)	($83,700)	(150)	(1,260)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 10, except figures under 25. Source: IMPLAN Input-Output Modelling System.

Glossary

ACCELERATED EROSION: Soil loss above natural levels resulting directly from human activities. Because of the slow rate of soil formation, accelerated erosion can lead to a permanent reduction in plant productivity.

ACID ROCK DRAINAGE (ARD) (ACID MINE DRAINAGE): The exposure, usually as a result of mining, of sulfide-bearing minerals to air and water, forming sulfuric acid. This acid dissolves metals such as lead, zinc, copper, arsenic, selenium, mercury, and cadmium, into ground and surface water. Acid rock/mine drainage can poison ground and drinking water and destroy aquatic life and habitat. Commonly mined ore bodies that pose the risk of acid rock drainage include gold, silver, copper, iron, zinc, and lead.

ACRE-FOOT: The volume of water or solids that could cover an acre at a depth of 1 foot, or 43,560 cubic feet.

ACUTE TOXICITY: Any poisonous effect produced by a single short-term exposure and resulting in severe biological harm or death.

ADMINISTRATIVE PROCEDURES ACT (APA): A federal statute that outlines administrative procedures that federal agencies must follow to determine information to be made public; publish material in the *Federal Register*; smaintain records, including those involving certain meetings and hearings; fulfill attendance and notification requirements for specific meetings and hearings; issue licenses, and review agency actions. This act also grants the public the rights to participate in the rulemaking process and comment on proposed rules.

ADIT: A nearly horizontal passage in an underground mine, driven from the surface, by which a mine may be entered, ventilated, or dewatered.

AGGRADATION: The building up of land surfaces by sedimentation or deposition of mineral matter.

ALASKA NATIONAL INTEREST LANDS CONSERVATION ACT (ANILCA): Public Law 96-487, approved December 2, 1980, (94 Stat. 2371), which designated certain public lands in Alaska as units of the National Park System, National Wildlife Refuge System, Wild and Scenic Rivers System, National Wilderness Preservation System, and National Forest System, resulting in general expansion of all systems.

ALEVIN: A young fish, especially a newly hatched salmon still attached to the yolk sac.

ALLUVIAL: Pertaining to material that is carried and deposited by running water.

ALLUVIAL FAN: A low, outspread, relatively flat to gently sloping mass of loose rock material deposited by a stream where it flows from a narrow mountain valley onto a plain or broad valley.

ALLUVIUM: Any sediment deposited by flowing water, as in a river bed, floodplain, or delta.

AMERICAN INDIAN RELIGIOUS FREEDOM ACT OF 1978 (AIRFA): A federal statute that makes it a policy to protect and preserve for American Indians, Eskimos, Aleuts, and native Hawaiians their inherent right of freedom to believe, express, and exercise their traditional religions. AIRFA allows them access to sites, use and possession of sacred objects, and freedom to worship through ceremonial and traditional rites. It further directs federal departments and agencies to evaluate their policies and procedures in consultation with native traditional religious leaders to determine changes needed to protect and preserve Native American cultural and religious practices.

ANADROMOUS FISH: Fish, such as salmon and steelhead, that hatch in fresh water, migrate to the ocean, mature there, and return to fresh water to reproduce.

ANAEROBIC: Characterized by the absence of oxygen.

ANIMAL UNIT MONTH (AUM): The amount of forage needed to sustain one cow, five sheep, or five goats for a month.

ANNUAL VEGETATION: Plants that complete their life cycles and die in 1 year or less.

AQUATIC HABITATS: Habitats confined to streams, rivers, springs, lakes, ponds, reservoirs, and other water bodies.

AQUATIC RESOURCES: Plants and animals that live within or are entirely dependent upon water to live; living resources of aquatic habitats (fish, invertebrates, amphibians); aquatic species.

AQUATIC SYSTEMS: A complete interacting system of organisms (aquatic species) considered together with their environment.

AQUIFER: A water-bearing bed or layer of permeable rock, sand, or gravel capable of yielding large amounts of water. See UNCONSOLIDATED AQUIFER.

AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC): A designated area on public lands where special management attention is required (1) to protect and prevent irreparable damage to fish and wildlife; important historic, cultural, or scenic values; or other natural systems or processes or (2) to protect life and safety from natural hazards.

ARID REGION: A region where precipitation is insufficient to support any but drought-adapted vegetation.

ASPECT: (1) the visual first impression of vegetation at a particular time or seen from a specific point. (2) The predominant direction of the slope of the land.

ATTENUATION: The process of decreasing contaminant concentration away from the source due to a variety of physical and chemical processes. Attenuation can occur in the unsaturated zone as contaminants move downward from the surface (from spills for example) or in the saturated zone within aquifers as contaminants move in the ground water flow system.

BACKFILL: Material used to replace soil and earth removed during mining.

BACKFILLING: The replacement of soil and earth removed during mining.

BACKGROUND LEVEL: The amount of a pollutant present in water or air from natural sources.

BANK CUBIC YARD (bcy): A unit volume for material in its natural state before disturbance, often referred to as "in-place" or "in-situ" material. See LOOSE CUBIC YARD.

BARREN SOLUTION: A solution in hydrometalurgical treatment from which all valuable constituents have been removed. See PREGNANT SOLUTION.

BASALT: Fine-grained, dark-colored igneous rock that is either intrusive or extrusive.

BASE FLOW: The portion of stream discharge derived from such natural storage sources as ground water, large lakes, and swamps but not derived from direct runoff or flow from stream regulation, water diversion, or other human activities.

BASE METAL: A metal inferior in value to gold and silver, a term generally applied to the commercial metals such as copper and lead.

BEDLOAD: Sediment in a stream that moves by sliding, rolling, or bounding on or near the streambed. See SUSPENDED SEDIMENT.

BENEFICIATION: The dressing or processing of ores to (1) regulate the size of a desired product, (2) remove unwanted constituents, and (3) improve the quality, purity, or assay grade of a desired product. Beneficiation includes concentration or other preparation of ore for smelting by drying, flotation, or magnetic separation.

BENTHIC: Occurring or living on or in the bottom of any water body.

BENTONITE: A clay mineral formed from the decomposing of volcanic ash. Commonly bentonite can readily absorb or adsorb water and well accordingly.

BEST AVAILABLE TECHNOLOGY AND PRACTICES: The applying of the most advanced systems, techniques, procedures, and controls, determined on a case-by-case basis by the regulatory agency.

BEVILL AMENDMENT: A provision of the Solid Waste Disposal Act Amendments (1980) to the Resource Conservation and Recovery Act (RCRA) that exempted from Subtitle C requirements the wastes from the extraction and beneficiation of ores and minerals, regardless of their chemical composition. The amendment further directed the U.S. Environmental Protection Agency either to develop Subtitle C regulations for this waste or determine that this exemption should continue, and to present its findings in a report to Congress.

BIOACCUMULATION: The net accumulation of a chemical by an organism as a result of uptake from all routes of exposure.

BIOLOGICAL ASSESSMENT: The gathering and evaluation of information on proposed endangered and threatened species and critical habitat and proposed critical habitat. Required when a management action potentially conflicts with endangered or threatened species, the biological

585

assessment is the way federal agencies enter into formal consultation with the Fish and Wildlife Service and describe a proposed action and the consequences to the species the action would affect.

BIOLOGICAL DIVERSITY (BIODIVERSITY): The full range of variability within and among living organisms and the ecological complexes in which they occur. Biological diversity encompasses ecosystem or community diversity, species diversity, and genetic diversity.

BIOLOGICAL OXYGEN DEMAND: A measure of the oxygen used in meeting the matabolic needs of aerobic microorganisms in water rich in organic matter.

BIOMAGNIFICATION: The concentration of certain substances up a food chain, an important mechanism in concentrating pesticides and heavy metals in organisms such as fish and raptors.

BIOMASS: The total amount of living material, plants and animals, above and below the soil surface in a biotic community.

BIOTIC COMMUNITIES: The assemblage of native and exotic plants and of a particular site or landscape, including microorganisms, fungi, algae, vascular and herbaceous plants, invertebrates, and vertebrates. These assemblages and their biotic and abiotic relationships serve landscape and watershed functions by promoting soil properties supporting water infiltration, recycling and transfer, species survival, and sustainable population dynamics.

BLOCK CAVING: A method of mining in which large blocks of ore are undercut and the ore breaks and caves under its own weight.

BUCKET-LINE DREDGE (BUCKET-LADDER DREDGE): A dredge whose digging mechanism consists of a bladderlike truss on the periphery of which is attached an endless chain that rides on sprocket wheels and on which buckets are attached.

BULKHEAD: A partition or wall in mines for protection against gas, fire, and water.

BULK SAMPLING: As part of exploration, the removal of large amounts of mineral substances for testing.

CANDIDATE SPECIES: Species not protected under the Endangered Species Act but under consideration by the U.S. Fish and Wildlife Service for inclusion on the list of federally threatened or endangered species.

CANOPY: The uppermost layer consisting of the crowns of trees or shrubs in a forest or woodland.

CARLIN TREND: An area 25 miles west of Elko in northeast Nevada that has become the most productive gold district in the United States. In this 5- by 40-mile area gold production over the past several years has exceeded 4 million ounces a year.

CARRYING CAPACITY: The maximum stocking rate possible without damaging vegetation or related resources. Carrying capacity may vary from year to year in the same area due to fluctuating forage production.

CASUAL USE: Mining activities that only negligibly disturb federal lands and resources. Casual use generally includes the collecting of geochemical, rock, soil, or mineral specimens using hand tools, hand panning, and non-motorized sluicing. It also generally includes use of metal detectors, gold spears, and other battery-operated devices for sensing the presence of minerals, and hand and battery-operated drywashers. Operators may use motorized vehicles for casual use activities if the use conforms to the regulations governing such use, off-road vehicle use designations in BLM land use plans, and temporary closures. Casual use does not include use of mechanized earth- moving equipment, truck-mounted drilling equipment, suction dredges, motorized vehicles in areas designated as closed to off-road vehicles, chemicals, or explosives. It also does not include occupancy or operations where the cumulative effects of the activities result in more than negligible disturbance. Under casual use, operators do not have to notify BLM, and operations do not need to be approved. But operations are subject to monitoring by BLM to ensure that federal lands do not undergo unnecessary or undue degradation. Casual use operations must be reclaimed.

CATION: An electrically charged particle (ion) with a positive charge.

CAVE RESOURCE: Any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge, including any cave resource therein, that is large enough to permit a person to enter, whether the entrance is excavated or naturally formed. Also included is any natural pit or sinkhole.

CENOZOIC: The most recent era of geologic history (65 million years ago until the present) during which the world's modern landforms, animals, and plants came into being.

CHAINED DOLLARS: Annual measures of real gross domestic product that have been adjusted with the use of an index that attempts to account for relative price changes and changes in output over time. These annual measures are considered to provide more accurate estimates of year-to-year changes in gross domestic product than measures published before 1996.

CHANNEL: A natural or artificial watercourse with a definite bed and banks to confine and conduct continuously or periodically flowing water.

CHANNEL MORPHOLOGY: The structure and form of a stream channel.

CHAPARRAL: A vegetation community consisting of dense and often thorny shrubs and small trees.

CHLOROSIS: The conditions of plants when chlorophyll fails to develop and plants are yellowish white to white and poorly developed.

CLAIM: See MINING CLAIM.

CLIMAX VEGETATION: The final vegetation community and highest ecological development of a plant community that emerges after a series of successive vegetational stages. The climax community perpetuates itself indefinitely unless disturbed by outside forces.

COLD DESERT: Areas that are consistently dry (evaporation equals or exceeds precipitation), that have 7 or fewer months when temperatures average above 50° F, and that have average annual temperatures below 65° F.

COLLUVIAL: (1) Processes related to the slow movement of the ground (creep) due to gravity; (2) a hillside deposit developed by mass movement of rock on slopes leading away from the exposed source rock (lode).

COLLUVIUM: Rock and soil accumulated at the foot of a slope from gravitational forces.

COMMON VARIETY MINERALS: Stone, gravel, pumice, pumicite, and cinders that, though possibly having value for trade, manufacture, the sciences, or the mechanical or ornamental arts, do not have a distinct, special value for such use beyond normal uses. On the public lands such minerals are considered saleable and are disposed of by sales or by special permits to local governments. See SALEABLE MINERALS, MINERAL MATERIALS, and UNCOMMON VARIETY MINERALS.

COMMUNITY: An assemblage of plant and animal populations in a common spatial arrangement.

COMPETENT ROCK: Rock that, because of its physical and geological character, can sustain openings without any structural support except pillars and walls left during mining.

CONE OF DEPRESSION: A change (depression) in the water table surface at the site of an active well, resulting from the withdrawal of water.

CONIFER: A tree of the order Coniferae with cones and needle-shaped or scalelike leaves.

CONIFEROUS: Pertaining to conifers, which bear woody cones containing naked seeds. See CONIFER.

CONSUMERS: Organisms, chiefly animals, that ingest other organisms or particulate organic matter.

COOL-SEASON PLANTS: Plants whose major growth occurs during the late fall, winter, and early spring. See WARM-SEASON PLANTS.

CORPORATE GUARANTEES (BONDING): The use of corporate assets as part or all of the financial assurance for reclamation.

COUNTRY ROCK (WALL ROCK): The general mass of rock next to a body of ore, as distinguished from the vein or ore deposit itself.

COVER: Any form of environmental protection that helps an animal stay alive (mainly shelter from weather and concealment from predators).

CRITICAL HABITAT, DESIGNATED: Specific parts of an area occupied by a federally listed threatened or endangered plant or animal at the time it is listed that contain physical or biological features essential to the conservation of the species or that may require special management or protection. Critical habitat may also include specific areas outside an area occupied by a federally listed species if the Secretary of the Interior determines that these areas are essential for the conservation of the species.

588

CRITICAL MINERALS: Minerals essential to the national defense, the procurement of which in war, while difficult, is less serious than those of strategic minerals because they can be either domestically produced or obtained in more adequate amounts or are less essential, and for which some degree of conservation and distribution control is needed. See STRATEGIC MINERALS.

CRYPTOBIOTIC (CRYTOGAMIC) CRUSTS: Biological communities that form a surface layer or crust on some soils. These communities consist of cyanobacteria (blue-green bacteria), microfungi, mosses, lichens, and green algae and perform many important functions, including fixing nitrogen and carbon, maintaining soil surface stability, and preventing erosion. Cryptobiotic crusts also influence the nutrient levels of soils and the status and germination of plants in the desert. These crusts are slow to recover after severe disturbance, requiring 40 years or more to recolonize even small areas.

CULTURAL PROPERTY: The definite location of a past human activity, occupation, or use identifiable through field inventory, historic documentation, or oral evidence. Cultural properties include prehistoric and historic archaeological remains, or architectural sites, structures, objects, or places with important public and scientific uses.

CULTURAL RESOURCE: The fragile and nonrenewable remains of human activity that are found in historic districts, sites, buildings, and artifacts and that are important in past and present human events.

CUTTERHEAD DREDGE: A hydraulic dredge in which the suction action is augmented by a rotating propeller that operates at the point of suction. The cutterhead performs two functions: (1) it cuts into and loosens compacted soils and soft rock, and (2) it increases dredge capacity by channeling the soils into the end of the suction pipe.

CYANIDE LEACHING: The extraction of a metal from an ore by its dissolution in a cyanide solution.

DECIDUOUS: Pertaining to plants that shed all their leaves every year in a certain season.

DE MINIMUS: Of insufficient significance to warrant judicial attention.

DESERT PAVEMENT: A desert ground surface of thin, smooth, or sheetlike, wind-polished, closely packed pebbles, boulders, gravel, and other rock fragments, where wind and sheetwash have removed all small particles. These fragments are commonly cemented by mineralized solution.

DETRITUS: Disintegrated matter such as rock fragments or organic debris accumulated in pond water or on mud or soil.

DEVELOPMENT (MINERAL): The preparation of a proven deposit for mining.

DEWATERING: The process of pumping large amounts of ground water from wells to lower the water table over a large area to allow an open pit or underground mine to operate in dry conditions.

DISCHARGE (WATER): The rate of flow or volume of water flowing in a stream at a given place or within a given period of time.

589

DISCOVERY: The knowledge of the presence of valuable minerals within or close enough to a location to justify a reasonable belief in their existence. Discovery is an extremely important to public lands mining because the Mining Law of 1872 provides that mining claims can be located only after a discovery is made. Discovery was first legally defined in a landmark Department of the Interior 1894 land decision—Castle versus Womble. The definition, now know as the "Prudent Person Test," described a discovery as "...where minerals have been found and the evidence is of such a character that a person of ordinary prudence would be justified in the further expenditure of his labor and means, with a reasonable prospect of success in developing a valuable mine..."

DISSEMINATED ORE: Ore carrying small particles of valuable minerals spread more or less uniformly through the worthless minerals, as distinct from massive ore, in which valuable materials occur in almost solid form with little waste material included.

DOLOMITE: A mineral that consists of calcium magnesium carbonate and is found in crystals and in extensive beds as a limestone.

DRAINAGE: The removal of excess water from land by surface or subsurface flow. See ACID ROCK DRAINAGE.

DRAWDOWN, GROUND WATER: A lowering of the ground water surface caused by pumping, measured as the difference between the original ground water level and the level after a period of pumping.

DRIFT: A voluntary or accidental dislodgment of aquatic invertebrates from the stream bottom into the water column, where they move or float with the current.

DRY DRILL HOLE: A drill hole in which no water is used for drilling.

ECHOLOCATION: A process used by bats for locating distant or invisible objects (prey) by detecting sound waves reflected back from the objects.

ECOLOGICAL BALANCE: The stability of an ecosystem resulting from interacting processes of its components.

ECOLOGICAL SUCCESSION: An ecosystem's gradual evolution to a stable state or climax. If through the ability of its populations and elements, an ecosystem can absorb changes, it tends to persist and become stable through time.

ECOSYSTEM: A functioning unit of nature combining biotic communities and the abiotic environments with which they interact.

EDGE EFFECT: The influence of two bordering biotic communities on each other.

EFFLUENT: Treated or untreated waste material discharged into the environment.

EIS STUDY AREA: The following 12 western states: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

590

ELECTROWINNING: The recovery of metal from an ore by means of electrochemical processes.

ELUVIATION: A process of removal of organic material and clay in solution or in suspension from the soil by percolating waters. The removal of soil material in suspension or solution from a layer or layers of a soil. The loss of material in solution is usually called "leaching." See ILLUVIATION.

EMERGENT VEGETATION: Aquatic plant species that are rooted in wetlands but extend above the water's surface. See SUBMERGENT VEGETATION.

ENDANGERED SPECIES: Any animal or plant species in danger of extinction throughout all or a significant portion of its range as designated by the U.S. Fish and Wildlife Service under provisions of the Endangered Species Act. See THREATENED SPECIES.

ENTRY: An application to acquire title to public lands.

ENVIRONMENTAL ASSESSMENT (EA): A concise public document for which a federal agency is responsible that does the following:

- Briefly gives enough evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI).
- Aid an agency's compliance with the National Environmental Act when no EIS is needed.
- Facilitate preparing an EIS when one is needed.

ENVIRONMENTAL IMPACT STATEMENT (EIS): An analytical document that portrays potential impacts on the human environment of a particular course of action and its possible alternatives. Required by the National Environmental Policy Act (NEPA), EISs are prepared for use by decision makers to weigh the environmental consequences of potential decisions.

EQUILIBRIUM PARTITIONING SEDIMENT GUIDELINES (ESG): The U.S. Environmental Protection Agency's chemical-specific guidance for assessing and protecting against contaminated sediments.

ERICACEOUS: Of, pertaining to, or concerning the heath family of plants, Ericaceae, for example, blueberry.

EROSION BLANKET: Material such as straw, jute matting, or rock that is applied to the land surface to minimize erosion of soil particles caused by the impact of rain drop splash and by flowing water.

EUTROPHICATION: The slow aging process of a lake evolving into a marsh and eventually disappearing. During eutrophication the lake is choked by abundant plant life. Human activities that add nutrients to a water body can speed up this action.

EVAPOCONCENTRATION: The process of a solution's becoming more concentrated as its liquid evaporates.

EVAPORITE: Sedimentary rock formed by the evaporation of a saline solution. Examples include rock salt, gypsum, and chemically precipitated limestone.

EVAPOTRANSPIRATION: The combined process by which water is transferred from the earth's surface (from soil, snow, water bodies, and vegetation) to the atmosphere. Also see TRANSPIRATION.

EXOTIC SPECIES: An animal or plant species that is not a part of an area's original fauna or flora. See NATIVE SPECIES.

EXPLORATION: The work of investigating a mineral deposit to determine by geological surveys, geophysical surveys, geochemical surveys, boreholes, pits, and underground workings if it is feasible to mine. Exploration is undertaken to gain knowledge of the size, shape, position, characteristics, and value of the deposit. For the proposed 3809 regulations, exploration means creating surface disturbance that is greater than casual use and that includes sampling, drilling, or developing surface or underground workings to evaluate the type, extent, quantity, or quality of mineral values present. Exploration does not include activities where material is extracted for commercial use or sale.

EXTRA LATERAL RIGHTS: Rights relating to the apex law. If a vein outcrops (apex or highest point) on the surface of a claim, the claimant of the vein's apex has rights to all of the vein that is continuous in the downward dip, including the portion of the vein outside the claim boundary.

FACTOR OF SAFETY: The ratio of the ultimate strength of a material to the allowable or working stress.

FAIR HABITAT CONDITION: The condition of a watershed that has been moderately affected by land uses, characterized by the removal or altering in the past of natural riparian vegetation (few large trees) and the presence of only limited amounts of large woody debris, fine sediments above natural levels, some adverse changes in water quality or quantity, and habitat that has only partly recovered or is still decreasing in trend.

FEDERAL LAND POLICY AND MANAGEMENT ACT (FLPMA): The act that (1) set out for the Bureau of Land Management standards for managing the public lands, including land use planning, sales, withdrawals, acquisitions, and exchanges; (2) authorized the setting up of local advisory councils representing major citizens groups interested in land use planning and management: (3) established criteria for review of proposed wilderness areas; and (3) provided guidelines for other aspects of public land management such as grazing.

FIRST-ORDER TRIBUTARY: A nonbranching headwater channel segment.

FISHERY: Habitat that supports the propagation and maintenance of fish.

FISH STOCK: A discrete population of a fish species that tends to inhabit the same waters and breed in the same stream.

FLOODPLAIN: Level streamside land that may be subject to flooding.

FLOW REGIMES: Characteristics of stream discharge over time. The natural flow regime is the regime that occurred historically.

FLUVIAL: Pertaining to streams or produced by stream action.

FORB: A herbaceous plant that is not a grass, sedge, or rush.

FREE WATER: Ground water free to move in response to gravity.

FUGITIVE DUST: Particulate matter emissions that do not pass through a stack, chimney, vent, pipe, or similar opening.

FUNCTIONAL AT RISK RIPARIAN-WETLAND AREAS: Areas that are in functional condition but an existing soil, water, or vegetation attribute makes them susceptible to degradation. See PROPER FUNCTIONING CONDITION and NONFUNCTIONAL RIPARIAN-WETLAND AREAS.

GAINING (EFFLUENT) STREAM: A stream or reach of a stream that receives water from the zone of saturation and provides base flow; its channel lies below the water table. See LOSING STREAM.

GEOPHYSICAL EXPLORATION: The use of geophysical instruments and methods to determine subsurface conditions by analyzing such properties as specific gravity, electrical conductivity, or magnetic susceptibility.

GRAMINOID HERBACEOUS VEGETATION: Herbaceous vegetation with the predominance of cover in grasses or sedges.

GRANDFATHER, TO: To exempt groups or individuals from provisions of laws or regulations because of preexisting conditions, such as exempting mining operations existing before new mining regulations are implemented from provisions of those new regulations.

GRIZZLY: In mining, a device for the coarse screening of bulk materials.

GROSS DOMESTIC PRODUCT (GDP): The sum of the gross state products of the 50 states.

GROSS STATE PRODUCT (GSD): The sum of the gross outputs of each of a state's industries minus intermediate goods and services purchased from other industries or imported. See INTERMEDIATE GOODS AND SERVICES.

GROUND WATER: Water that has percolated downward from the ground surface through the soil pores.

GROWTH MEDIA: See REPLACEMENT GROWTH MEDIA.

GULLY EROSION: The removal of soil by the forming of relatively large gullies or channels cut into the soil by concentrated surface runoff. See SURFACE EROSION.

HABITAT: The natural abode of a plant or animal, including all biotic, climatic, and soil factors affecting life.

HABITAT GENERALIST: Animals that can find food and shelter in a variety of ways and can survive quite well in different habitats.

HABITAT MANAGEMENT PLAN: A site-specific wildlife habitat plan.

HARDPAN: A hardened soil layer in the lower A horizon or the B horizon caused by cementation of soil particles with organic matter or with materials such as silica or calcium carbonate.

HEAP: A large, engineered pile of ore over which chemical agents such as cyanide are sprinkled in extracting metals by heap leaching.

HEAP LEACHING: A low-cost technique for extracting metals from ore by percolating leaching solutions through heaps of ore placed on impervious pads. This method is generally used on low-grade ores.

HEAP LEACH PAD: A large impermeable foundation or pad used as a base for ore during heap leaching.

HEAVY METAL: Any of the metals that react readily with dithizone, including zinc, copper, cobalt, lead, bismuth, gold, cadmium, iron, manganese, nickel, tantalum, tellurium, platinum, and silver.

HERBACEOUS: Pertaining to or characteristic of an herb (fleshy-stem plant) as distinguished from the woody tissue of shrubs and trees.

HERD MANAGEMENT AREA (HMA): The area of wild horse or burro habitat covered by a herd management area plan.

HERD MANAGEMENT AREA PLAN (HMAP): A site-specific plan that defines objectives for a herd management area and prescribes actions to meet the objectives. This plan outlines details of burro or horse capture plans, adoption programs, and long-term population management.

HIGHBANKER: A placer mining tool similar to a sluice box, but instead of being placed in a stream, the highbanker uses a water pump to carry water to higher and sometimes richer placer reserves. The highbanker also can run more material in less time than a sluice.

HIGHWALL: The unexcavated face of exposed overburden and ore in an open pit mine.

HOME RANGE: The area in which an animal travels in the scope of natural activities.

HORIZON: See SOIL HORIZON.

HOST ROCK: A body of rock with younger rocks or mineral deposits introduced into it or formed within or next to it.

HYDRAULIC CONDUCTIVITY: The property of a soil that governs the rate of ground water flow within it. The hydraulic conductivity of a particular soil is defined by the size, abundance, and geometry of its open pores, and the rate of ground water flow increases with increasing hydraulic conductivity. Fine-grained soils such as clay and silt have very small pores and have much lower hydraulic conductivities than coarse-grained soils such as sand and gravel.

HYDRAULIC GRADIENT: The slope of the free surface of water in a stream flowing in an open channel.

HYDRAULIC RESISTANCE: The resistance to the flow of water for a given stream channel, as defined by the mathematical relationship between stream depth, bed material size, mean flow velocity, and shear velocity.

HYDRIC: Characterized by decided moist or wet conditions.

HYDROCARBONS: Any of a vast family of compounds containing carbon and hydrogen in various combinations, found especially in fossil fuels. Hydrocarbons in the atmosphere resulting from evaporation and incomplete combustion may be a major source of air pollution.

HYDROGRAPHIC AREAS: Areas defined and used by the State of Nevada to delineate watersheds into the smallest units possible for conducting hydrologic studies. The U.S. Geological Survey also bases its Nevada hydrological studies on these areas. Hydrographic areas are numbered 1-234.

HYDROLOGIC BALANCE: An accounting of water inflow to, outflow from, and storage in a hydrologic unit such as a drainage basin, aquifer, lake, or reservoir; the relationship between evaporation, precipitation, runoff, and change in water storage.

HYDROSTATIC PRESSURE: The pressure exerted by the water in any given point in a water body at rest. The hydrostatic pressure of ground water is generally due to the weight of water at higher levels in the zone of saturation.

HYPORHEIC ZONE: The area where water in a stream channel has moved back into the subsurface sediments. The hyporheic zone may occur under or next to the streambed.

IGNEOUS ROCK: Rock, such as granite and basalt, that has solidified from a molten or partially molten state.

ILLUVIATION: The process of deposition of soil material removed from one horizon to another in the soil, usually from an upper to a lower horizon in the soil profile. See ELUVIATION.

INCLINE: A nonvertical mining shaft, usually along the dip of a vein.

INDEPENDENT MILLSITE: A millsite whose mill does not depend on specific mines for the minerals it processes.

INDUSTRIAL MINERALS: Rock and minerals that are not produced as sources of metals and are not mineral fuels. Examples include salt, gravels, building materials, talc, and sands.

INFILTRATION: The downward entry of water into the soil or other material.

595

IN SITU MINING: A method of extracting valuable minerals from ore by remobilizing or leaching them from where they occur in the ground. Under this process the ore deposit is drilled with holes in a grid pattern, and a dissolving or leaching solution is injected through the holes into the deposit, where the chemicals extract the desired minerals. The pregnant liquid is then recovered at a different well or series of wells and is piped to a recovery plant. There the minerals are recovered. The barren solution is then returned to the injection wells, and the cycle begins again.

INTERIOR BOARD OF LAND APPEALS (IBLA): The Department of the Interior, Office of Hearings and Appeals board that acts for the Secretary of the Interior in responding to appeals of decisions on the use and disposition of public lands and resources. Because IBLA acts for and on behalf of the Secretary of the Interior, its decisions usually represent the Department's final decision but are subject to the courts.

INTERMEDIATE GOODS AND SERVICES: Goods and services that are purchased for further reprocessing and resale, as opposed to final goods and services, which are sold to ultimate users. For example, wool would be an intermediate good, whereas a wool shirt would be a final good.

INVERSION: The state of the atmosphere in which a layer of cool air is trapped near the earth's surface by an overlying layer of warm air so that the lower layer cannot rise. Serious air pollution problems may result from air pollutants being emitted into the limited mixing depth below the inversion.

INVERTEBRATES: Animals without backbones or internal bony skeletons.

ISOPLETH: A line on a map connecting points at which a given variable has a specified constant value.

JIB: The lifting arm of a crane or derrick having a pulley at its outer end over which the hoisting rope passes.

JIG: An appliance in which a vertically pulsed column of water is manipulated to stratify crushed ore with lighter particles above and heavier particles below.

JURISDICTIONAL WETLANDS: Wetlands regulated by the Army Corps of Engineers under Section 404 of the Clean Water Act. The Corps and the Environmental Protection Agency define such wetlands as follows: Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. See WETLANDS

KARST: A area underlain by limestone in which erosion has formed sinkholes, fissures, caverns, and underground streams.

LEACHATE: The liquid that has percolated through and dissolved minerals out of ore.

LEACHING: The separating or dissolving of soluble constituents from a rock or ore by chemical solutions or water.

LEACH PAD: See HEAP LEACH PAD.

596

LEASABLE MINERALS: Minerals whose extraction from federal land requires a lease and the payment of royalties. Leasable minerals include coal, oil and gas, oil shale and tar sands, potash, phosphate, sodium, and geothermal steam.

LEGAL LAND DESCRIPTION: The method of locating or describing the land in relation to the public land survey.

LEK: An assembly area where birds, especially sage grouse, carry on display and courtship behavior.

LIGNIN: The major noncellulose constituent of wood.

LITTER: The uppermost layer of organic debris on the soil surface, essentially the freshly fallen or slightly decomposed vegetal material.

LOADING: The total amount of a pollutant generated from a specific area of land or received by a water resource during a fixed period of time. See ORGANIC LOADING.

LOAMY: Intermediate in texture and properties between fine- and course-textured soils.

LOCATABLE MINERALS: Minerals that may be acquired under the Mining Law of 1872, as amended.

LOCATABLE-TYPE MINERALS: Minerals that, if located on public lands, would be considered locatable under the Mining Law of 1872, as amended. In the Economic Conditions section of Chapter 3 of this EIS the term "locatable-type minerals" refers to mineral production from all land ownership types (federal and nonfederal). Therefore, the portion produced only on BLM-managed lands is a subset of the larger "locatable-type" category.

LOCATION: The act of taking or appropriating a parcel of mineral land, including the posting of notices, the recording thereof when required, and marking the boundaries so they can be readily traced; also the claim acquired by an act of location. See MINING CLAIM.

LOCATION QUOTIENT: An index for comparing an area's share of a particular activity with the area's share of some basic or aggregate phenomenon.

LODE: A mineral deposit in solid rock.

LODE CLAIM: A public lands mining claim that contains valuable minerals occurring in a vein or lode.

LODE MINING: Mining of a mineral deposit in solid rock.

LOOSE CUBIC YARD (lcy): A unit volume for material that is in a loose, broken, or blasted state or that has been excavated or loaded. See BANK CUBIC YARD.

LOSING (INFLUENT) STREAM: A stream or reach of a stream that contributes water to the zone of saturation and develops bank storage; its channel lies above the water table. See GAINING STREAM.

MACROINVERTEBRATES: Large or exceptionally prominent animals that lack a spinal column.

MACROPHYTE: Any plant that can be seen with the unaided eye, such as aquatic mosses, ferns, liverworts, or rooted plants.

MASS MOVEMENT: A single landslide or the gradual simultaneous downhill movement of the whole mass of loose earth material on a slope face.

MAXIMUM CONTAMINANT LEVEL (MCL): The maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards.

MAXIMUM CONTAMINANT LEVEL GOAL (MCLG): A number that is associated with no adverse health effects from drinking water containing a particular contaminant over a lifetime; a nonenforceable, ideal health goal issued as part of the National Primary Drinking Water Regulations.

MESOZOIC: The era of geologic history (245 million to 65 million years ago) during which the world's animal and plant life changed dramatically. The Mesozoic is called the age of the dinosaurs because it witnessed the evolution and extinction of these creatures. See PALEOZOIC.

METAMORPHIC ROCK: Any rock derived from preexisting rocks by mineralogical, chemical, and structural changes, essentially in the solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment at depth in the earth's crust.

METES AND BOUNDS: The boundaries of land established by reference to natural or artificial monuments along the boundaries as distinguished from boundaries established by beginning at a fixed starting point and running stated compass courses and stated distances.

METRIC TON: 1.102 short tons or 2,204 pounds.

MICROCLIMATE: Local site-specific climatic conditions that differ from the general climate because of local differences in elevation and exposure.

MICROHABITAT: A small habitat within a larger one in which environmental conditions differ from those in the surrounding area. A hole in a tree trunk or an animal carcass is a microhabitat within a forest.

MIL: A unit of length equal to 1/1,000 of an inch.

MILL: A plant in which ore is treated for the recovery of valuable minerals or valuable minerals are concentrated into a smaller bulk for shipping to a smelter or other reduction works.

MILLSITE CLAIM (MILLSITE): A site located on nonmineral land and used for erecting a mill or reduction works, or for other uses reasonably incident to support of a mine. Millsites are limited to 5 acres and may be located either by metes and bounds or by legal subdivision. See LOCATION and MINING CLAIM.

MINE: An opening or excavation in the earth for extracting minerals.

MINE CAPACITY: The greatest amount of production a mine is designed to produce.

MINE DRAINAGE: Any water forming on or discharging from a mine. See ACID ROCK DRAINAGE.

MINERAL: Any solid or fluid inorganic substance that can be extracted from the earth for profit.

MINERAL ACTIVITY: In this EIS, mining and mineral exploration.

MINERAL CLAIMANT: A person, association, corporation, or government that claims minerals rights or title in the public lands.

MINERAL ENTRY: The filing of a claim on public land to obtain the right to any minerals it may contain.

MINERALIZATION: The processes taking place in the earth's crust resulting in the formation of valuable minerals or ore bodies.

MINERAL MATERIALS: Materials such as common varieties of sand, stone, gravel, pumice, pumicite, and clay, that are not obtainable under the mining or leasing laws but that can be acquired under the Mineral Materials Act of 1947, as amended. See COMMON VARIETY MINERALS.

MINERALOGY: The study of minerals: their formation, occurrence, properties, composition, and classification.

MINERAL PROSPECT: A mineral property whose value has not been proved by exploration.

MINERAL RIGHTS: Ownership of all minerals, including all rights needed for access, exploration, development, mining, ore dressing, and transportation.

MINERAL WITHDRAWAL: A formal order that withholds federal lands and minerals from entry under the Mining Law of 1872 and closes the area to mineral location (staking mining claims) and development.

MINE TAILING IMPOUNDMENT: An area closed at its lower end by a constraining wall or dam into which mill effluents are run and from which, after solids have settled out, clear water may be returned via penstocks and piping.

MINIMAL HABITAT CONDITION: Major alterations in a watershed, in water quality or quantity, in natural stream habitat, or in riparian areas, characterized by few or no large trees or mature native vegetation in riparian areas, little or no large woody debris, few and shallow pools, and excessive sedimentation of the streambed.

MINIMIZE: To reduce the adverse impact of an operation to the lowest practical level.

MINING CLAIM: A parcel of land that a miner takes and holds for mining purposes, having acquired the right of possession by complying with the Mining Law and local laws and rules. A single mining claim may contain as many adjoining locations as the locator may make or buy. There are four categories of mining claims: lode, placer, millsite, and tunnel site. For the proposed 3809 regulations, mining claim means any unpatented mining claim, millsite, or tunnel site located under the mining laws. The term also applies to mining claims and millsites that were located in the California Desert Conservation Area and patented after the enactment of the Federal Land Policy and Management Act of 1976. See LOCATION, LODE CLAIM, PLACER CLAIM, MILLSITE CLAIM, and TUNNEL SITE CLAIM.

MINING CLAIM VALIDITY EXAMINATION: An examination of a mining claim by a mineral examiner to determine if the claim has a discovery or if all requirements for a millsite claim have been met. All claims for which a patent application has been filed must undergo such an exam.

MINING DISTRICT: An area, usually designated by name, with described or understood boundaries, where minerals are found and mined under rules prescribed by the miners, consistent with the Mining Law of 1872.

MINING LAW OF 1872 (GENERAL MINING LAW): The federal act that, with its amendments, formed the framework for the mining of locatable minerals on the public lands. This law declared that "valuable" mineral deposits rather than simply "mineral deposits" were to be free and open to exploration and purchase, limited individual claims to 20 acres, required $100 worth of assessment work yearly, and allowed milling or processing claims of 5 acres or less to be entered on nonmineral lands.

MINING LAWS: the Lode Law of July 26, 1866, as amended (14 Stat. 251); the Placer Law of July 9, 1870, as amended (16 Stat. 217); and the Mining Law of May 10, 1872, as amended (17 Stat. 91); as well as all laws supplementing and amending those laws, including the Building Stone Act of August 4, 1892, as amended (27 Stat. 348); the Saline Placer Act of January 31, 1901 (31 Stat. 745); the Surface Resources Act of 1955 (30 U.S.C. 611- 614); and the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.).

MINING LOCATION: A mining claim on the public lands.

MITIGATION: As defined in 40 CFR 1508.20, one or more of the following: (1) avoiding impacts altogether by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying impacts by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating impacts over time by preservation and maintenance operations during the life of the action; and (5) compensating for impacts by replacing or providing substitute resources or environments.

MODIFICATION: A change in a Plan of Operations that requires some level of review by BLM because it exceeds what was described in the approved Plan of Operations.

MONOCULTURE: The growth of only a single plant species within an area.

MORAINE: An accumulation of boulders, stones, and other earth debris carried and deposited by a glacier.

MOST APPROPRIATE TECHNOLOGY AND PRACTICES : The use of technology and practices that have demonstrable feasibility, success, and practicality in meeting performance standards.

MUD: The mixture of water or oil and clay, and sometimes other special materials, used as a drill circulation liquid in drilling a borehole.

MULTIPLIER: The number of times new investment spending will be respent to produce a certain amount of new income.

NATIONAL AMBIENT AIR QUALITY STANDARDS (KNACKS): The allowable concentrations of air pollutants in the ambient (public outdoor) air specified in 40 CFR 50. National ambient air quality standards are based on the air quality criteria and divided into primary standards (allowing an adequate margin of safety to protect the public health) and secondary standards (allowing an adequate margin of safety to protect the public welfare). Welfare is defined as including (but not limited to) effects on soils, water, crops, vegetation, human-made materials, animals, wildlife, weather, visibility, climate, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being.

NATIONAL CONSERVATION AREA: A congressionally designated public land area that contains important resources and whose management objectives are (1) to conserve and protect these resources, (2) to maintain environmental quality, and (3) to provide for present and future users within a framework of multiple use and sustained yield.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA): The federal law, going into effect on January 1, 1970, that established a national policy for the environment and requires federal agencies (1) to become aware of the environmental ramifications of their proposed actions, (2) to fully disclose to the public proposed federal actions and provide a mechanism for public input to federal decisionmaking , and (3) to prepare environmental impact statements for every major action that would significantly affect the quality of the human environment.

NATIONAL HISTORIC LANDMARKS: Nationally significant historic sites, buildings, and objects designated by the Department of the Interior for having exceptional value in illustrating and interpreting the heritage of the United States. Only 3% of the properties on the National Register of Historic Places are national historic landmarks. See NATIONAL REGISTER OF HISTORIC PLACES.

NATIONAL HISTORIC PRESERVATION ACT (NHPA): A federal statute that established federal program to further the efforts of private agencies and individuals in preserving the Nation's historic and cultural foundations. NHPA (1) authorized the National Register of Historic Places, (2) established the Advisory Council on Historic Preservation and a National Trust Fund to administer grants for historic preservation, and (3) authorized the development of regulations to require federal agencies to consider the effects of federally assisted activities on properties included on or eligible for the National Register of Historic Places. See NATIONAL REGISTER OF HISTORIC PLACES.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES): A process for controlling the amount of pollution discharged into waters by requiring polluters to obtain NPDES permits from the states involved and to comply with discharge standards. The NPDES is mandated by the Federal Water Pollution Control Act Amendments.

NATIONAL PRIMARY DRINKING WATER STANDARDS (NPDWS): Developed by the Environmental Protection Agency to keep drinking water clean and protect the public from waterborne disease, these standards define either a maximum contaminant level or a treatment technique requirement to control the presence of contaminants in drinking water.

NATIONAL REGISTER OF HISTORIC PLACES: The official list, established by the National Historic Preservation Act, of the Nation's cultural resources worthy of preservation. The National Register lists archeological, historic, and architectural properties (districts, sites, buildings, structures, and objects) nominated for their local, state, or national significance by state and federal agencies and approved by the National Register Staff. The National Register is maintained by the National Park Service. See NATIONAL HISTORIC PRESERVATION ACT.

NATIONAL WILD AND SCENIC RIVERS SYSTEM: A system of nationally designated rivers and their immediate environments that have outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, and other similar values and are preserved in a free-flowing condition. The system consists of three types of streams: (1) recreation—rivers or sections of rivers that are readily accessible by road or railroad and that may have some development along their shorelines and may have undergone some impoundments or diversion in the past, (2) scenic—rivers or sections of rivers free of impoundments with shorelines or watersheds still largely undeveloped but accessible in places by roads, and (3) wild—rivers or sections of rivers free of impoundments and generally inaccessible except by trails, with watersheds or shorelines essentially primitive and waters unpolluted.

NATIVE SPECIES: A species that is part of an area's original fauna or flora. See EXOTIC SPECIES.

NEOTROPICAL MIGRATORY BIRDS: Birds that travel to Central America, South America, the Caribbean, and Mexico during the fall to spend the winter and then return to the United States and Canada during the spring to breed. These birds include almost half of the bird species that breed in the United States and Canada.

NONFUNCTIONAL RIPARIAN-WETLAND AREAS: Areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate the stream energy of high flows and thus are not reducing erosion, improving water quality, and performing the other functions of an area in properly functioning condition. See FUNCTIONAL AT RISK RIPARIAN-WETLAND AREAS and PROPER FUNCTIONING CONDITION.

NONNATIVE SPECIES: See EXOTIC SPECIES.

NOTICE: The notification a mining operator must submit to BLM of the intention to begin an operation that will disturb 5 acres or less a year within a mining claim or project area. The intent of a Notice is to permit operations with limited geographic disturbance to begin after a quick review for potential resource conflicts and to eliminate the need for federal action. A Notice requires no special forms, but an operator must submit specific information. BLM must complete its review of the Notice within 15 calendar days of its receipt unless more information is needed to determine if the operation would cause unnecessary or undue degradation.

NOTICE-LEVEL OPERATION: A mining or exploration operation involving more than casual use but requiring that the operator submit only a Notice rather than a Plan of Operations.

NOTICE OF NONCOMPLIANCE: An authorized officer's decision, sent to the mining operator and claimant, that (1) details provisions of the regulations that a mining operation has violated and (2) states corrective actions that the operator must take within a specified time. See RECORD OF NONCOMPLIANCE.

NOXIOUS WEED: According to the Federal Noxious Weed Act (PL 93-629), a weed that causes disease on has other adverse effects on humans and their environment and is therefore detrimental to public health and the agriculture and commerce of the United States.

NUTRIENT CYCLING: The circulation of chemical elements such as nitrogen, oxygen, carbon, and phosphorus in specific pathways from the abiotic (not involving or produced by organisms) portions of the environment into organic substances in plants and animals and then back into abiotic forms.

OBLIGATE: Essential, necessary, unable to exist in any other state, mode, or relationship.

OFF-ROAD VEHICLE (ORV) or OFF-HIGHWAY VEHICLE (OHV): Any vehicle capable of or designed for travel on or immediately over land, water, or other natural terrain, deriving motive power from any source other than muscle. This definition excludes (1) any nonamphibious registered motorboat; (2) any fire, emergency, or law enforcement vehicle while being used for official or emergency purposes; and (3) any vehicle whose use is expressly authorized by a permit, lease, license, agreement, or contract issued by an authorized officer or otherwise approved.

OPEN PIT MINING: A surface mining method in which overlying rock and soil are removed to expose an ore body, which is then drilled, blasted, and hauled from the pit.

OPERATIONS: All functions, work, facilities, and activities on public lands in connection with prospecting, exploration, discovery, and assessment work, development, extraction, and processing of mineral deposits locatable under the mining laws; reclamation of disturbed areas; and all other reasonably incident uses, whether on a mining claim or not, including the building of roads, transmission lines, pipelines, and other means of access across public lands for support facilities.

OPERATOR: Any person who manages, directs, or conducts mining operations at a project area, including a parent entity or an affiliate who materially participates in such management, direction, or conduct. An operator on a particular mining claim may also be the mining claimant.

ORE: A mineral deposit of high enough quality to be mined at a profit.

ORE BODY: A mineralized mass whose characteristics have been determined and deemed commercially viable. The term ore body is used once the economic limits of the mineralized mass and its grade have been examined.

ORE DRESSING: Sorting ore.

ORE RESERVES: The portion of a mineral deposit that can be profitably mined. Use of this term implies detailed knowledge of all the geological, engineering, economic, and environmental parameters that might affect the profitability of an operation. For a new mining project or for the mining of new zones in an existing mine, a formal feasibility study is conducted to evaluate all the project's parameters.

ORGANIC LOADING: The total amount of organic matter generated from a specific area of land or received by a water resource during a fixed period of time. See LOADING.

OROGRAPHIC EFFECT: The effect of mountains on the passing flow of air. Mountains may cause lifting or diverting of air, creation of clouds, and decreases in leeward precipitation.

OVERBURDEN: All the earth and other materials that overlie a natural mineral deposit.

OVERBURDEN RATIO: In strip mining the ratio of the vertical thickness of overburden to the vertical thickness of the underlying ore.

OVERSTORY: The layer of foliage in a forest canopy.

OXIDATION: The process of combining with oxygen.

OXIDE ORE: Ore containing minerals that have been altered by oxidation or the weathering process.

PALEONTOLOGICAL RESOURCES (FOSSILS): The physical remains of plants and animals preserved in soils and sedimentary rock formations. Paleontological resources are important for understanding past environments, environmental change, and the evolution of life.

PALEOZOIC: An era of geologic time between the Precambrian and the Mesozoic (about 550 million to 245 million years ago) whose beginning witnessed an explosion in the diversity of multicelled animals and whose conclusion experienced the greatest mass extinctions in history. See MESOZOIC.

PARENT MATERIAL (SOIL): The unconsolidated more or less chemically weathered mineral or organic matter from which the upper level of the soil profile has developed.

PARTICULATE MATTER: Fine liquid or solid particles suspended in the air and consisting of dust, smoke, mist, fumes, and compounds containing sulfur, nitrogen, and metals.

PASSERINE BIRDS: Birds of the order Passeriformes, which includes perching birds and songbirds such as blackbirds, jays, finches, warblers, and sparrows. More than half of all known birds belong to this order.

PATENT: The instrument by which the Federal Government conveys title to the public lands.

PAY GRAVEL: Placer gravel of good to strong profitability.

PAY STREAK: The areas of concentration of gold in placer deposits.

PAY LAYER: Ore, a mineral deposit of high enough quality to be mined at a profit.

604

PERCHED WATER TABLE: A water table, usually of limited area, held above the main body of ground water by an impermeable layer such as clay.

PERENNIAL STREAM: A stream that flows continuously during all seasons of the year.

PERENNIAL VEGETATION: Plants that have a life cycle of 3 or more years.

PERIPHYTON: Microscopic plants and animals that are firmly attached to such solid surfaces under water as rocks, logs, pilings, and other structures.

PERSONAL INCOME: The sum of wage and salary disbursements, other labor income, proprietors' income, rental income of persons, personal dividend income, personal interest income, and transfer payments to persons, less personal contributions for social insurance.

pH: A measure of acidity or hydrogen ion activity. Neutral is pH 7.0. All values below 7.0 are acidic, and all values above 7.0 are alkaline.

PHOTOSYNTHESIS: The manufacture by plants of carbohydrates and oxygen from carbon dioxide and water in the presence of chlorophyll, using sunlight as an energy source.

PHREATOPHYTE: A plant that absorbs its water from a permanent supply in the ground.

PHYLA: In taxonomy, the primary divisions of the plant and animal kingdoms.

PHYSIOGRAPHIC PROVINCE: A region defined by a unified geologic history and a characteristic geologic structure and climate that differs from adjoining regions.

PHYTOPLANKTON: Unattached microscopic plants of plankton, subject to movement by wave or current action. See PLANKTON.

PIT LAKE: Water body that forms at the bottom of an open pit mine when mining extends below the water table.

PLACER: An alluvial deposit of sand and gravel containing valuable minerals such as gold.

PLACER CLAIM: A mining claim located upon gravel or ground whose mineral contents are extracted by the use of water.

PLACER DEPOSIT: A mass of gravel, sand, or similar material resulting from the crumbling and erosion of solid rocks containing particles of gold or other valuable minerals that have been derived from rocks or veins.

PLACER MINING: A method of mining in which the overburden is removed to expose gold-bearing gravel deposits beneath. The gravel is then sluiced to separate the gold.

PLAN: See PLAN OF OPERATIONS.

PLANKTON: Suspended, floating, or weakly swimming microscopic plants and animals in the water that provide a basis for the aquatic food chain. Plankton include bacteria, algae, protozoans, rotifers, larvae, and small crustaceans. See PHYTOPLANKTON.

PLAN OF OPERATIONS: A plan for mining exploration and development that an operation must submit to BLM for approval when more than 5 acres a year will be disturbed or when an operator plans to work in an area of critical environmental concern or a wilderness area. A Plan of Operations must document in detail all actions that the operator plans to take from exploration through reclamation.

PLAYA: A dried-up, flat-floored area consisting of thin, evenly layered sheets of fine clay, silt, or sand, and representing the bottom of a shallow, undrained desert lake basin in which water accumulates and is quickly evaporated, usually leaving deposits of soluble salts.

PLEISTOCENE MEGAFAUNA: Large mammals that inhabited North America before the end of the last glaciation and that became extinct. Such animals include the mammoth, mastodon, camel, giant slot, Bison antiquus, and Bison occidentalis.

PLUME: A visible or measurable discharge of a contaminant from a given point of origin. A plume can be visible or thermal in water, or visible in the air.

POPULATION: Within a species, a distinct group of individuals that tend to mate only with members of the group. Because of generations of inbreeding, members of a population tend to have similar genetic characteristics.

PORE WATER PRESSURE (PORE PRESSURE): The stress transmitted through the fluid that fills the voids between particles of a soil or rock mass.

POROSITY: A rock, soil, or other material's property of containing interstices. Porosity is commonly expressed as a percentage of the bulk volume of a material occupied by interstices. See PRIMARY POROSITY and SECONDARY POROSITY.

PRECAMBRIAN ERA: The earliest era of geological history, extending from 4.5 billion to 540 million years ago and encompassing 7/8 of the earth's history. Just before the end of the Precambrian, complex multicellular organisms, including animals, evolved.

PRECIOUS METAL: A general term for gold, silver, or any of the minerals of the platinum group.

PREGNANT POND: A pond containing liquid that is charged with valuable minerals.

PREGNANT SOLUTION: A solution in hydrometalurigical treatment that is charged with valuable minerals and awaits their removal. See BARREN SOLUTION.

PREY BASE: Populations and types of prey species available to predators, for example fish species and populations available to river otters.

PRIMARY CONTAINMENT: The vessel, package, tank, or pond that holds hazardous materials. See SECONDARY CONTAINMENT

PRIMARY POLLUTANT: A pollutant emitted directly from a source. See SECONDARY POLLUTANT.

PRIMARY POROSITY: The porosity that developed during the final stages of sedimentation or was present within sedimentary particles at the time of deposition. See POROSITY and SECONDARY POROSITY.

PRIMARY PRODUCERS: Green plants that can manufacture food from simple organic substances.

PRIMARY PRODUCTION: The production of organic substances by photosynthesis; the amount of material so produced per unit time.

PROBABLE MAXIMUM PRECIPITATION: The precipitation that may be expected from the most severe combination of critical meteorologic conditions and that is reasonably possible in an area as found in the National Weather Service Hydrometeorological Reports.

PROJECT AREA: The area of land upon which an operator conducts mining operations, including the area needed for building or maintaining of roads, transmission lines, pipelines, or other means of access.

PROPER FUNCTIONING CONDITION (RIPARIAN-WETLAND AREAS): The condition where (1) enough vegetation, landform, or large woody debris is present to dissipate the stream energy of high water flows, thereby reducing erosion and improving water quality; (2) sediments are filtered, bedload is captured, and floodplains develop; (3) flood water retention and ground water recharge are improved, root masses that stabilize streambanks against cutting action develop, and diverse ponding and channel characteristics are created to provide the habitat and the water depth, duration, and temperature needed for fish production, waterfowl breeding, and other uses; and (4) greater biodiversity is supported. See FUNCTIONAL AT RISK RIPARIAN-WETLAND AREAS and NONFUNCTIONAL RIPARIAN-WETLAND AREAS.

PROPRIETARY INCOME: Payments received by the self-employed as income, including income received by private business owners, doctors, and lawyers.

PRUDENT OPERATOR: An operator who in good faith tries to develop a mineral operation, doing the best possible job, both economically and environmentally.

PUBLIC LANDS: Any land and interest in land owned by the United States and administered by the Secretary of the Interior through the Bureau of Land Management, without regard to how the United States acquired ownership, except for (1) land located on the Outer Continental Shelf and (2) land held for the benefit of Indians, Aleuts, and Eskimos.

PUBLIC RANGELANDS IMPROVEMENT ACT OF 1978: An act that sought to improve range conditions on the public lands. Among its provisions are a definition of the current grazing fee formula and the requirement that allotment management plans be developed "in careful and considered consultation, cooperation, and coordination" with the lessees, permittees, and landowners involved.

607

QUARTERNARY PERIOD: The current period of geologic history and second period of the Cenozoic era, which is believed to have covered the last 2 million to 3 million years.

RAPTORS: Birds of prey.

RARE EARTH METALS: A group of widely distributed metals consisting of the elements scandium, yttrium, and 15 elements of atomic numbers 57 to 71, inclusive. These metals have the same arrangement of the two external shells of electrons in their atoms and resemble one another closely in chemical and physical properties, being thus most difficult to separate from each other. It is for this property, rather than their actual rarity in nature, that they are so described.

REACH: A specified length of a stream or channel.

REACTIVITY: A substance's tendency to undergo chemical reaction either by itself or with other materials with the release of energy. Undesirable effects such as pressure buildup, temperature increase, or formation of noxious, toxic, or corrosive byproducts may result from a substance's reactivity to heating, burning, direct contact with other materials, or other conditions.

RECHARGE AREA: An area that absorbs water that eventually reaches the zone of saturation in one or more aquifers.

RECLAMATION: Measures required by the proposed 3809 regulations after the disturbance of public lands from mining operations to meet performance standards and achieve conditions required by BLM at the end of operations. Components of reclamation may include (1) isolating, controlling, or removing acid-forming, toxic, or deleterious substances; (2) regrading and reshaping to conform with adjacent landforms, facilitate revegetation, control drainage, and minimize erosion; (3) rehabilitating fisheries or wildlife habitat; (4) placing growth media and establishing self-sustaining revegetation; (5) removing or stabilizing buildings, structures, or other support facilities; (6) plugging drill holes and closing underground workings; and (7) providing for postmining monitoring, maintenance, or treatment.

RECORD OF DECISION: A document signed by a responsible official recording a decision that was preceded by the preparing of an environmental impact statement.

RECORD OF NONCOMPLIANCE: Under the 43 CFR 3809 regulations, an administrative compliance procedure and document that BLM issues to an operator who has not resolved a notice of noncompliance. If an operator is issued a record of noncompliance, BLM can upgrade all of the operator's Notice-level operations to Plan-level operations and require the operations to be bonded at 100% of reclamation costs. See NOTICE OF NONCOMPLIANCE.

RECREATION OPPORTUNITY SPECTRUM (ROS): A planning process that provides a framework for defining classes of outdoor recreation environments, activities, and experience opportunities. In ROS the settings, activities, and opportunities for experiences are arranged along a continuum or spectrum of six classes: primitive, semi-primitive nonmotorized, semiprimitive motorized, roaded natural, rural, and urban. The resulting ROS analysis defines specific geographic areas on the ground, each of which encompasses one of the six classes.

REDD: The spawning ground or nest of various fishes.

608

REDUCERS (DECOMPOSERS): Organisms, usually bacteria or fungi, that break down complex organic material into simple compounds.

REFRACTORY-GRADE ORES: Ores that resist the action of chemical reagents in the normal treatment processes and generally require roasting or other means to fully recover valuable minerals.

REGIONAL AQUIFER: An aquifer that occupies a relatively large area.

RELICT: A remnant or fragment of the vegetation of an area that remains from a former period when the vegetation was more widely distributed.

RAIN SHADOW: An area on the leeward side of mountains that is relatively dry because the mountains block the movement of moisture-laden winds and cause most of the precipitation to fall on the windward side.

REPLACEMENT GROWTH MEDIA: Material below the C horizon of the soil that can be substituted for topsoil or subsoil when it is equal or superior in quality as a surface cover for growing plants on reconstructed mine surfaces.

RESERVE BASE: The part of an identified resource that meets specified minimum physical and chemical criteria for current mining and production. The reserve base includes resources that are currently economic and marginally economic and some that are currently subeconomic.

RESOURCE ADVISORY COUNCILS (RACs): Advisory councils appointed by the Secretary of the Interior and consisting of representatives of major public land interest groups (commodity industries, recreation, environmental, and local area interests) in a state or smaller area. RACs advise the Bureau of Land Management, focusing on a full array of multiple use public land issues. RACs also help develop fundamentals for rangeland health and guidelines for livestock grazing.

RESOURCE MANAGEMENT PLAN (RMP): A BLM planning document, prepared in accordance with Section 202 of the Federal Land Policy and Management Act, that presents systematic guidelines for making resource management decisions for a resource area. An RMP is based on an analysis of an areas's resources, their existing management, and their capability for alternative uses. RMPS are issue oriented and developed by an interdisciplinary team with public participation.

RIGHT-OF-WAY: A permit or easement that authorizes the use of lands for specified purposes, such as for a forest access road or a powerline.

RILL: A small, intermittent water course with steep sides, usually only a few inches deep.

RIPARIAN AREA: A form of wetland transition between permanently saturated wetlands and upland areas. Riparian areas exhibit vegetation or physical characteristics that reflect the influence of permanent surface or subsurface water. Typical riparian areas include lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels. Excluded are ephemeral streams or washes that lack vegetation and depend on free water in the soil.

609

ROASTING: Heating sulfide-bearing ores to release sulfur dioxide.

ROCK CHARACTERIZATION: A program of testing and evaluating the physical, chemical, and mineralogical nature of rock to evaluate its potential to produce acid rock drainage or other deleterious leachate.

SALEABLE MINERALS: Common variety minerals on the public lands, such as sand and gravel, which are used mainly for construction and are disposed of by sales or special permits to local governments. See COMMON VARIETY MINERALS and UNCOMMON VARIETY MINERALS.

SALMONID: Any fish of the Salmonidae family, including salmon and trout.

SCARIFY: To break the surface of the soil with a narrow bladed instrument.

SCOPING: An early and open process for determining the scope of issues to be addressed in an environmental impact statement and the significant issues related to a proposed action. Scoping may involve public meetings; field interviews with representatives of agencies and interest groups; discussions with resource specialists and managers; and written comments in response to news releases, direct mailings, and articles about the proposed action and scoping meetings.

SECONDARY CONTAINMENT: An outer structure that would contain hazardous materials in the event of chronic or catastrophic spillage. See PRIMARY CONTAINMENT.

SECONDARY POLLUTANT: A pollutant that is formed by a chemical or photochemical reaction in the atmosphere rather than emitted from an identifiable source. See PRIMARY POLLUTANT.

SECONDARY POROSITY: The porosity developed in a rock formation after its deposition or emplacement, either through the natural processes of dissolution or stress distortion, or artificially through acidization or the mechanical injection of coarse sand. See POROSITY and PRIMARY POROSITY.

SECTION 106 COMPLIANCE: The requirement of Section 106 of the National Historic Preservation Act that any project funded, licensed, permitted, or assisted by the Federal Government be reviewed for impacts to significant historic properties and that the State Historic Preservation Officer and the Advisory Council on Historic Preservation be allowed to comment on a project.

SECTION 7 CONSULTATION: The requirement of Section 7 of the Endangered Species Act that all federal agencies consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service if a proposed action might affect a federally listed species or its critical habitat.

SEDIMENTARY ROCKS: Rocks, such as sandstone, limestone, and shale, that are formed from sediments or from transported fragments deposited in water.

SEDIMENTATION: The process or action of depositing sediment.

SEDIMENT YIELD: The amount of sediment removed from a watershed over a specified period, usually expressed as tons, acre-feet, or cubic yards of sediment per unit of drainage area per year.

SEEDBANK: Seeds stored in the soil, generally as hard seed, that are viable and will germinate given the proper conditions. This seedbank is mainly built up by seed produced by plants growing on or next to the site over many years. Species long gone may still be represented in the seedbank if their seed is especially long lived.

SEGREGATION: Any act such as a withdrawal or exchange that suspends the operation of the public land laws. See WITHDRAWAL.

SENSITIVE LANDS: Any areas recognized in BLM land use or activity plans where BLM has determined that a Plan of Operations is required to provide detailed review of project effects on unique, irreplaceable, or outstanding historical, cultural, recreational, or natural resource values, such as threatened or endangered species or their critical habitat.

SENSITIVE SPECIES: All species that are under status review, have small or declining populations, live in unique habitats, or need special management. Sensitive species include threatened, endangered, and proposed species as classified by the Fish and Wildlife Service and National Marine Fisheries Service.

SERAL: Pertaining to the successional stages of biotic communities.

SETTLING POND: A natural or artificial pond for recovering the solids from the excess water discharged from a washery–the place where ore is freed from impurities and dust by washing.

SHAFT: A vertical or inclined opening to an underground mine.

SHEAR STRENGTH: The maximum resistance of a soil to shearing stress.

SHORT SELLING: Selling a security that the seller does not own but is committed to repurchasing eventually. Short selling is used to capitalize on an expected decline in a security's price

SHORT TON: 2,000 pounds.

SKARN: Contact metamorphic rock rich in iron; ores consisting almost entirely of lime-bearing silicates and derived from nearly pure limestones and dolomites in which large amounts of silicon, aluminum, iron, and magnesium have been introduced.

SLOPE FAILURE: The downward and outward movement of rock or unconsolidated material as a unit or series of units.

SLOPE STABILITY: The resistance of any slope to failure by sliding or collapsing.

SLUICE BOX (SLUICE): A long, inclined trough or launder containing in its bottom, riffles that provide a lodging place for heavy minerals in ore concentration. The material to be concentrated is carried down through the sluices on a current of water. Sluice boxes are widely used in placer operations for concentrating such minerals as gold and platinum from stream gravels.

SNOWPACK: A seasonal accumulation of slow-melting packed snow.

SOIL HORIZON: A layer of soil or soil material roughly parallel to the land surface and differing from adjoining genetically related layers in physical, chemical, and biological properties or characteristics, such as color, structure, and texture.

SOIL PROFILE: A vertical section of the soil from the surface through all of its horizons.

SOIL REGIME: The layer of soil or growth media roughly parallel to the land surface upon which plants and their roots will penetrate and grow.

SOIL STRUCTURE: The physical constitution of soil material as expressed by size, shape, and the degree of development of primary soil particles and voids into naturally or artificially formed structural units.

SOIL TEXTURE: The relative proportions of the three size groups of soil grains (sand, silt, and clay) in a mass of soil.

SPAWNING GRAVELS: Stream-bottom gravels where fish deposit and fertilize their eggs. The covering of these gravels with silt can block the supply of oxygen to the eggs or serve as a cementing agent to prevent fry from emerging.

SPECIAL STATUS AREAS: Areas that BLM has determined to have resources of unique or distinct value. These lands have a variety of designations, depending on the authority under which they were designated and the resources present. Such areas include (1) lands in the California Desert Conservation Area (CDCA) designated by the CDCA Plan as "controlled" or "limited" use areas, (2) areas in or designated for potential addition to the National Wild and Scenic Rivers System, (3) areas of critical environmental concern (ACECs), (4) designated wilderness areas administered by BLM, and (5) areas closed to off-road vehicle use.

SPECIAL STATUS SPECIES: Plant or animal species listed as threatened, endangered, candidate, or sensitive by federal or state governments. See SENSITIVE SPECIES.

SPLIT-ESTATE: Land whose surface rights and mineral rights are owned by different entities. Such a condition commonly occurs when surface rights are owned by the Federal Government and the mineral rights are privately or state owned.

SPOIL: In surface mining, overburden or waste excavated and redeposited.

STOCK (FISH): A group of fish that is genetically self-sustaining and isolated geographically or temporally during reproduction. Generally, stock refers to a local population of fish. More specifically, stock refers to a local population, especially of salmon, steelhead, or other anadromous fish, that originates from specific watersheds as juveniles and as adults generally returns to its birth streams to spawn.

STOCK RAISING HOMESTEAD LANDS: Lands patented under the Stock Raising Homestead Act of December 29, 1916. These lands were not considered suitable for cultivation but were considered suitable for stock grazing. All minerals on these lands were retained by the United States.

STOPE: An area in an underground mine where ore is mined.

STRATEGIC MINERALS: Minerals essential to the national defense for the supply of which during war we are wholly or partly dependent upon sources outside the continental limits of the United States, and for which strict measures are needed to control conservation and distribution. See CRITICAL MINERALS.

STRATIFICATION, LAKE: In a lake the presence of two or more horizontal layers of water of differing characteristics, such as density.

STREAM ORDER: A stream classification system based on the number of tributaries a stream has. The smallest unbranched tributary in a watershed is designated an Order 1 stream. A stream formed by the confluence of two Order 1 streams is designated an Order 2 stream. A stream formed by the confluence of two Order 2 streams is designated an Order 3 stream, and so on.

STRIP MINING: A form of surface mining in which relatively shallow overburden is stripped off the surface and the ore extracted. Usually designed for shallow, tabular deposits that are longer than they are wide, strip mines typically are located in areas of rugged topography where the deposit is interbedded between uneconomic rock units.

STRIPPING RATIO: In open pit mining, the ratio of the total waste removed to the total ore mined.

STRUCTURAL DIVERSITY (OF A STREAM CHANNEL): Within a stream channel the diversity of objects that control water movement.

STRUCTURE (STREAM CHANNEL): Any object, usually large, in a stream channel that controls water movement.

STUDY AREA: See EIS STUDY AREA.

SUBMERGENT VEGETATION: Aquatic plants that grow only within water and do not break the water's surface. See EMERGENT VEGETATION.

SUBPERMAFROST AQUIFERS: Permeable material below the base of permafrost. In the continuous permafrost zone these aquifers consist mostly of consolidated rock. In the discontinuous permafrost zone, they commonly consist of unconsolidated deposits.

SUBSISTENCE USES: As stated in the Alaska National Interest Lands Conservation Act (ANILCA), the customary and traditional uses by rural Alaska residents of wild renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption, for barter, or sharing for personal or family consumption; and for customary trade.

SUBSOIL: The B horizon of soils with distinct profiles, or the soil below the plowed soil (or its equivalent of surface soil) in soils with weak profile development.

613

SUBSTRATE: The mineral or organic material that forms the bed of a stream; the base upon which an organism lives; the surface on which a plant or animal grows or is attached.

SUCTION DREDGE: A dredge that lifts material and pumps it through a suction pipe.

SULFIDE ORE: Ore in which sulfide minerals predominate.

SUMMER RANGE: Range that is grazed mainly during the summer growing season. See WINTER RANGE.

SURFACE EROSION: Erosion that removes materials from the surface of the land as distinguished from gully, or channel erosion. See GULLY EROSION.

SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977 (SMCRA): A federal act that set rules for surface mining and reclamation of mined land, providing for transfer of much authority to states with approved programs.

SUSPENDED SEDIMENT: The very fine soil particles that are maintained in suspension in water for a considerable time by the upward components of turbulent currents or because they are fine enough to form a colloidal suspension. See BEDLOAD.

SWELL FACTOR: The percentage of increase in the volume of waste rock from before its excavation to its placement in a waste rock dump.

TAILINGS: The waste matter from ore after the extraction of economically recoverable metals and minerals.

TAKE: As defined by the Endangered Species Act, "to harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect, or attempt to engage in any such conduct."

TAKING: In Anglo-American legal tradition, the right of eminent domain–the right of the sovereign or government to take private property to meet public needs. The takings clause of the Fifth Amendment to the U.S. Constitution prohibits the taking of private property for public use without just compensation. But recently, under the concept of regulatory taking, landowners have been demanding that the government pay them for losses resulting from regulations that have reduced profits from the use of their land.

TAXA: A group of organisms sharing common characteristics in varying degrees of distinction and constituting one of the categories in taxonomic classification, such as a phylum, order, family, genus, or species.

TERMINAL WETLAND: A wetland that forms from water flowing into a closed basin that has no outlet. Most such wetlands are small and only seasonally filled with water, but they may support unique aquatic species.

TERRESTRIAL SPECIES: Ground-dwelling plants and animals.

TERTIARY: The earlier (12 million to 5 million years ago) of the two geologic periods in the Cenozoic era of geologic time.

THREATENED SPECIES: Any plant or animals species likely to become endangered within the foreseeable future throughout all or a part of its range and designated by the U.S. Fish and Wildlife Service under the Endangered Species Act. See ENDANGERED SPECIES.

TOTAL MAXIMUM DAILY LOAD (TMDL): Under the Clean Water Act, the amount of pollution a water body can absorb and still support aquatic life and uses such as water for drinking and recreation. The Clean Water Act requires states to list lakes, rivers, and streams that do not meet water quality standards. For each of those water bodies, a state must establish a total maximum daily load (TMDL) for each nonattainment pollutant, including nonpoint source pollutants, at a level to ensure that water quality standards can be met.

TOTAL DISSOLVED SOLIDS (TDS): Salt—an aggregate of carbonates, bicarbonates, chlorides, sulfates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts. High TDS solutions can change the chemical nature of water, exert varying degrees of osmotic pressure, and often become lethal to aquatic life.

TOTAL SUSPENDED PARTICULATES (TSP): Particulate matter in the atmosphere that is generally less than 50 micrometers in diameter and that settles slowly and includes droplets, dust, fumes, pollen, sand, and soot.

TRACE METALS: Metals that are present in small concentrations.

TRADITIONAL CULTURAL PROPERTY (TCP): A cultural property that is eligible for inclusion in the National Register of Historic Places because of its association with a living community's cultural practices or beliefs that (a) are rooted in that community's history and (b) are important in maintaining the community's continuing cultural identity.

TRADITIONAL LIFEWAY VALUES: Values that are important for maintaining a group's traditional system of religious belief, cultural practice, or social interaction. A group's shared traditional lifeway values are abstract, nonmaterial, ascribed ideas that cannot be discovered except through discussions with members of the group. These values may or may not be closely associated with definite locations.

TRANSPIRATION: The photosynthetic and physiological process by which water in plants is transported as water vapor to the atmosphere.

TRIBE (TRIBAL): Terms that refer to federally recognized Indian tribes.

TROPHIC LEVEL: The level in a nutritive series of an ecosystem in which a group of organisms in a certain stage in the food chain secures food in the same general manner. The first or lower trophic level consists of producers (green plants), the second level consists of herbivores, the third level consists of secondary carnivores, and the fourth level consists of reducers (decomposers).

TROY OUNCE: A unit of measure based on troy weight (12 ounces to a pound) and equal to 1.09714 avoirdupois ounces. (An avoirdupois ounce is the conventional U.S. weight measure in which 16 ounces equal 1 pound.)

TUFF: A compacted pyroclastic deposit of volcanic ash and dust that may contain up to 50% sediments such as sand or clay.

TUNDRA: Treeless arctic and alpine areas where cover may consist of bare ground, grasses, sedges, forbs, dwarf shrubs, mosses, or lichens.

TUNNEL: A nearly horizontal underground passage open to the surface at both ends.

TUNNEL SITE CLAIM: A mining claim located to secure an area for a tunnel. A tunnel site claim may be located on land where a tunnel is run to develop a vein or lode, or for intersecting unknown veins or lodes. See LOCATION and MINING CLAIM.

UNCOMMON VARIETY MINERALS: On the public lands stone, gravel, pumice, pumicite, and cinder deposits that have distinct and special properties making them commercially valuable for use in a manufacturing, industrial, or processing operation. Such minerals are locatable under the Mining Law of 1872, as amended. In determining a deposit's commercial value, the following factors may be considered: quality and quantity of the deposit, geographic location, accessibility to transportation, and proximity to market or point of use. See COMMON VARIETY MINERALS.

UNCONSOLIDATED AQUIFER: An aquifer that occurs in sediment that is loosely arranged or unstratified, or whose particles are not cemented together. See AQUIFER.

UNGULATES: Hoofed animals, including ruminants but also horses, tapirs, elephants, rhinoceroses, and swine.

UNNECESSARY OR UNDUE DEGRADATION: Under the proposed final 3809 regulations, the affect of conditions, activities, or practices that (1) fail to comply with one or more of the following: the performance standards in §3809.420, the conditions of an approved Plan of Operations, operations described in a complete Notice, and other federal and state laws for environmental and cultural resource protection; (2) are not reasonably incident to prospecting, mining, or processing; (3) fail to attain a stated level of protection or reclamation required by law in such areas as the California Desert Conservation Area, wild and scenic rivers, BLM-administered portions of the National Wilderness Preservation System, and BLM-administered national monuments and national conservation areas; or (4) occur on mining claims or millsites located after October 21, 1976 (or on unclaimed lands), result in substantial irreparable harm to significant scientific, cultural, or environmental resources of the public lands; and inflict harm that cannot be effectively mitigated.

UPLANDS: Lands at higher elevations than alluvial plains or low stream terraces; all lands outside the riparian-wetland and aquatic zones.

VALID EXISTING RIGHTS: Locatable mineral development rights that existed when the Federal Land Policy and Management Act (FLPMA) was enacted on October 21, 1976. Some areas are segregated from entry and location under the Mining Law to protect certain values or allow certain uses. Mining claims that existed as of the effective date of the segregation may still be valid if they can meet the test of discovery of a valuable mineral required under the Mining Law. Determining the validity of mining claims located in segregated lands requires BLM to conduct a validity examination and is called a "valid existing rights" determination.

VANDALISM: The unauthorized collecting, excavating, or defacing of cultural resources.

VASCULAR: Having vessels for circulating or transmitting plant or animals fluids.

VEGETATION COMMUNITY: An assemblage of plant populations in a common spatial arrangement.

VEIN: A well-defined, typically tabular zone or belt of mineral-bearing rock confined between nonmineralized rock.

VESICLE: A cavity or variable space in lava formed by the entrapment of a gas bubble while the lava was solidifying.

VISION QUEST: A solitary vigil by an adolescent American Indian male to seek spiritual power and learn through a vision of a guardian spirit.

VISITOR DAY: 12 visitor hours, which may be aggregated continuously, intermittently, or simultaneously by one or more people.

VISUAL RESOURCE MANAGEMENT (VRM): The planning, design, and implementing of management objectives to provide acceptable levels of visual impacts for all BLM resource management activities.

VISUAL RESOURCE MANAGEMENT (VRM) CLASS: The degree of visual change that is acceptable within the characteristic landscape. Based on the physical and sociological characteristics of any given homogeneous area, the VRM class serves as a management objective.

WARM-SEASON PLANTS: Plants whose major growth occurs during the spring, summer, or fall, and are usually dormant in winter. See COOL-SEASON PLANTS.

WASTE ROCK (WASTE): Barren rock at a mine or material that is too low in grade to be of economic value.

WATERSHED: The total area above a given point on a stream that contributes runoff water to the streamflow at that point.

WEATHERING: The disintegration and decomposition of rocks and other earth materials through exposure to the atmosphere. Weathering is one of the major factors in soil formation.

WETLANDS: Areas that are inundated or saturated by surface or ground water often and long enough to support and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. See JURISDICTIONAL WETLANDS.

WETTED PERIMETER: The length of the wetted contact between a stream of flowing water and the stream bottom in a vertical plane at right angles to the direction of flow.

WILD AND SCENIC RIVER: See NATIONAL WILD AND SCENIC RIVERS SYSTEM.

WILDERNESS AREA: A congressionally designated area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, that is protected and managed to preserve its natural conditions and that (1) generally appears to have been affected mainly by the forces of nature, with human imprints substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres or is large enough to make practical its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

WILDERNESS STUDY AREA: On BLM-managed lands, a roadless area that has been inventoried (but not designated by Congress) and found to have wilderness characteristics as described in Section 603 of the Federal Land Policy and Management Act of 1976 and Section 2(c) of the Wilderness Act of 1964. BLM manages wilderness study areas to protect their wilderness characteristics until Congress decides whether to designate them as wilderness.

WILD HORSES AND BURROS (WILD FREE-ROAMING HORSES AND BURROS): All unbranded and unclaimed horses and burros using public lands as all or part of their habitat.

WINTER RANGE: Range that is grazed during winter. See SUMMER RANGE.

WITHDRAWAL: An action that restricts the use of public lands by removing them from the operation of some or all of the public land or mining laws. See SEGREGATION and MINERAL WITHDRAWAL.

ZONE OF SATURATION (PHREATIC ZONE): A subsurface zone in which all the interstices are filled with water under pressure greater than that of the atmosphere.

References

Alaska Department of Fish and Game. 1992. *Salmon Fisheries in the Yukon River, Alaska 1991*. Regional Information Report No. 3A92-01. Anchorage.

Allen, Edith B. 1988. Some Trajectories of Succession in Wyoming Sagebrush Grassland: Implications for Restoration. In *The Reconstruction of Disturbed Arid Lands, An Ecological Approach*, edited by Edith B. Allen, pp. 89-112. AAAS Selected Symposium 109. Washington, D.C.: Westview Press for the American Association for the Advancement of Science.

Amey, Earle B. 1997. Gold Commodity Specialist, Minerals Information Team, U.S. Geological Survey. *Minerals Yearbook 1996: Gold.* (1998 URL: http://minerals.er.usgs.gov/minerals/pubs/commodity/gold/index.html#myb).

Arizona Department of Mines and Mineral Resources. 1998. *Mineral Rights in Arizona: Laws and Regulations.* Phoenix, AZ.

Barrett, J.C., G.D. Grossman, and J. Rosenfeld. 1992. Turbidity-induced Changes in Reactive Distance of Rainbow Trout. *Transactions of the American Fisheries Society* 121:437-443.

BEA. See U.S. Department of Commerce, Bureau of Economic Analysis.

Bednarz, J.C. 1984. The Effect of Mining and Blasting on Breeding Prairie Falcons *(Falco mexicanus)* Occupancy in the Caballo Mountains, New Mexico. *Raptor Research* 18(1):16-19.

Bell, M.C. 1986. *Fisheries Handbook of Engineering Requirements and Biological Criteria.* Portland, OR: U.S. Army Corps of Engineers, Office of the Chief of Engineers, Fish Passage Development and Evaluation Program.

Bell, Bernard. 2000. Economist, U.S. Department of Labor, Bureau of Labor Statistics. Data electronically transferred from agency database.

Benson, L. and R.A. Darrow. 1981. *Trees and Shrubs of the Southwestern Deserts*. 3rd ed. Tucson: University of Arizona Press.

Bevanger, K. 1994. Three Questions on Energy Transmission and Avian Mortality. *CINCLUS, Norwegian Journal of Ornithology* 17:107-114.

Bird, David A. 1993. Geochemical Modeling of Mine Pit Water: An Overview and Application of Computer Codes. Master's thesis, University of Nevada, Reno.

Bjerklie, D.C. and J.D. Laperriere. 1985. Gold Mining Effects on Stream Hydrology and Water Quality, Circle Quadrangle, Alaska. *Water Resources Bulletin* 21:235-243.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat Requirements of Salmonids in Streams. In *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats,* edited by W.R. Meehan, pp. 83-138. American Fisheries Society Special Publication 19. Bethesda, MD: American Fisheries Society.

Blackburn, W.H. and P.T. Tueller. 1970. Pinyon and Juniper Invasion in Black Sagebrush Communities in East Central Nevada. *Ecology* 51:841-848.

BLM. See U.S. Department of the Interior, Bureau of Land Management.

Brady, N.C. 1974. *The Nature and Property of Soils.* 8th ed. New York: MacMillan.

Braun, Clait E. 1986. Changes in Sage Grouse Lek Counts with the Advent of Surface Coal Mining. In *Issues and Technology in the Management of Impacted Western Wildlife: Proceedings of a National Symposium, Glenwood Springs, Colorado, February 4-6, 1985,* edited by Robert D. Comer and others, pp. 227-231. Boulder, CO: Thorne Ecological Institute.

_____. 1998. Biologist, Colorado Division of Wildlife, Wildlife Research Center, Fort Collins, CO. Personal communication.

_____. 1999. Sage Grouse Declines in Western North America: What Are the Problems? *Proceedings of the Western Association of Fish and Wildlife Agencies* 78:139-156.

Brown, David E. (editor). 1982. Biotic Communities of the American Southwest—United States and Mexico. *Desert Plants* 4(1-4).

Brown, Lauren. 1985. *Grasslands*. New York: Alfred A. Knopf.

Brown, P.E. and R.D. Berry. 1991. Bats: Habitat, Impacts, and Mitigation. In *Issues and Technology in the Management of Impacted Wildlife,* pp 26-30. Boulder CO: Thorne Ecological Institute.

Buck, Brian W. and Robert J. Bayer. 1989. Geologic and Hydrologic Considerations for Construction of Cyanide Heap Leach Facilities. In *Geology and Hydrology of Hazardous-Waste, Mining Waste, Waste-Water, and Repository Sites in Utah,* pp. 107- 113. Publication 17. Salt Lake City: Utah Geological Association.

Buhl, K.J. and S.J. Hamilton. 1990. Comparative Toxicity of Inorganic Contaminants Released by Placer Mining to Early Life Stages of Salmonids. *Ecotoxicology and Environmental Safety* 20:325-342.

Bureau of the Census. See U.S. Department of Commerce, Bureau of the Census.

Bye-Jech, Shirley. 1998. Outdoor Recreation Planner, Bureau of Land Management, Cody Field Office, Cody, WY. Personal communication.

Call, M.W. 1979. *Habitat Management Guides for Birds of Prey.* Bureau of Land Management Technical Note 338. Denver, CO: U.S. Department of the Interior, Bureau of Land Management.

Canfield, T.J., N.E. Kemble, W.G. Brumbaugh, F.J. Dwyer, C.G. Ingersoll, and J.F. Fairchild. 1994. Use of Benthic Invertebrate Community Structure and the Sediment Quality Triad to Evaluate Metal-Contaminated Sediment in the Upper Clark Fork River, Montana. *Environmental Toxicology and Chemistry* 13(12):1999-2012.

Canter, L.W., J.M. Robertson, and R.M. Westcott. 1991. Identification and Evaluation of Biological Impact Mitigation Measures. *Journal of Environmental Management* 33:35- 50.

Carlson, R.F. and K. Karle. 1997. Assessment of Past Reclamation Activities. Unpublished paper presented at a workshop at the University of Alaska, Fairbanks on April 22, 1997.

Cavanaugh, Tara. 1998. Mining Contamination of Ground Water: The Need for Legislation and Reform: *University of Denver Water Law Review* 2:60-79.

Caterpillar Inc. 1996. *Caterpillar Performance Handbook.* Edition 26. Peoria, IL.

Center for Science in Public Participation and National Wildlife Federation. 2000. *Hardrock Reclamation Bonding Practices in the Western United States.* Boulder, CO: National Wildlife Federation.

Center for Wildlife Law and Defenders of Wildlife. 1998. *State Endangered Species Acts: Past, Present and Future.* Washington, D.C.: Center for Wildlife Law and Defenders of Wildlife.

Chambers, Jeanne C. 1989. Topsoil Considerations for Mine Reclamation in the Great Basin. Paper presented at shortcourse on reclamation of Mining District Lands in the Great Basin, October 3-4, 1989, Reno, NV. Sponsored by the Nevada Cooperative Extension.

Chaney E., W. Elmore, and W.S. Platts. 1993. *Managing Change: Livestock Grazing on Western Riparian Areas.* Produced for the Environmental Protection Agency. Eagle, ID: Northwest Resource Information Center, Inc.

Chapman, G. 1973. Effect of Heavy Metals on Fish. In *Heavy Metals in the Environment,* pp. 141-162. Report SEMN-WR-D16.73. Corvallis: Oregon State University, Water Resources Research Institute.

Chertudi, C. 1986. *Blackbird Mine: Past and Present.* Boise, ID: Idaho Clean Water.

Churchill, E.A. Jr. 1990. Stream Glaciation. Paper presented at 2nd Annual Fish Habitat Improvement Workshop of the American Fisheries Society, July 10-12, Anchorage, AK. Available from U.S. Army Corps of Engineers, Anchorage.

Clark, D.R. Jr. and R.L. Hothem. 1991. Mammal Mortality at Arizona, California, and Nevada Gold Mines Using Cyanide Extraction. *California Fish and Game* 77(2):61-69.

Clark, T.W, A.P. Curlee, and R.P. Reading. 1996a. Crafting Effective Solutions to the Large Carnivore Conservation Problem. *Conservation Biology* 10(4):940-948.

Clark, T.W., P.C. Paquet, and A.P. Curlee. 1996b. General Lessons and Positive Trends in Large Carnivore Conservation. *Conservation Biology* 10(4):1055-1058.

Cole, E.K., M.D. Pope, and R.G. Anthony. 1997. Effects of Road Management on Movement and Survival of Roosevelt Elk. *Journal of Wildlife Management* 61(4):1115-1126.

Colenso, B.E., M.S. Boyce, and J. Tate Jr. 1980. Developing Criteria for Reclamation of Sage Grouse Habitat on a Surface Coal Mine in Northeastern Wyoming. In *Proceedings of the Symposium: Surface Mining Hydrology, Sedimentology, and Reclamation*, pp. 27-31. Lexington: University of Kentucky.

Committee on Hardrock Mining on Federal Lands; Committee on Earth Resources; Board on Earth Sciences and Resources; Commission on Geosciences, Environment, and Resources; National Research Council. 1999. *Hardrock Mining on Federal Lands*. Washington, D.C.: National Academy Press.

Cooper, A.C. 1965. *The Effect of Transported Stream Sediments on the Survival of Sockeye and Pink Salmon Eggs and Alevin*. International Pacific Salmon Fisheries Commission Bulletin 18. New Westminster, CA: International Pacific Salmon Fisheries Commission.

Cordell, H. Ken, John Bergstrom, Lawrence Hartmann, and Donald English. 1989. *An Analysis of the Outdoor Recreation and Wilderness Situation in the United States: 1989-2040.* General Technical Report RM-189. Ft. Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Cordone, A.J. and D.W. Kelley. 1961. The Influence of Inorganic Sediments on the Aquatic Life of Streams. *California Department of Fish and Game* 47(2):189-228.

Council of Economic Advisers. 2000. *Economic Report of the President*. Transmitted to the Congress, February 2000. Together with the Annual Report of the Council of Economic Advisers. Washington, D.C.: Government Printing Office.

Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. FWS/OBS-79/31. Washington, D.C.: Government Printing Office.

Crompton, E. James. 1995. *Potential Hydrologic Effects of Mining in the Humboldt River Basin, Northern Nevada*. Water Resources Investigations Report 94-4223. Carson City, NV: U.S. Geological Survey.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, and J.L. Reveal. 1972. *Intermountain Flora: Vascular Plants of the Intermountain West*, U.S.A. Vol. 1. New York: Hafner Publishing Co. for the New York Botanical Garden.

Dalness, Bill. 2000. Geologist, Bureau of Land Management, New Mexico State Office, Santa Fe, NM. Personal communication.

622

Dames & Moore and others. 1986. A *Water Use Assessment of Selected Alaska Stream Basins Affected by Placer Gold Mining*. Anchorage: Alaska Department of Environmental Conservation.

Day, Warren. 1999. Geologist, U.S. Geological Survey, Denver, CO. Personal communication.

Dobra, John L. 1997. *The U.S. Gold Industry 1996*. Nevada Bureau of Mines and Geology Special Publication 21. Reno: Mackay School of Mines, University of Nevada, Reno.

_____. 1999. *The U.S. Gold Industry 1998*. Nevada Bureau of Mines and Geology Special Publication 25. Reno: Mackay School of Mines, University of Nevada, Reno.

Dobra, John L. and Michael Evans. 1999. Economic Analysis of Proposed DOI Rulemaking Subpart 3809-Surface Management. Attachment to comment letter on *Surface Management Regulations for Locatable Mineral Operations Draft EIS* from National Mining Association. Washington, D.C.

Drever, James I. 1991. *Water Resources Technical Report for the Betze Project*. Ft. Collins, CO: ENSR Consulting and Engineering.

Driscoll, Fletcher G. 1986. *Ground Water and Wells*. 2nd edition. St. Paul, MN: Johnson Division.

Edelstein, Daniel L., Commodity Specialist, Minerals Information Team, U.S. Geological Survey. 1997. *Minerals Yearbook 1996:Copper.* (1998 URL: http://minerals.er.usgs.gov/minerals/pubs/commodity/copper/).

_____. 1999. *Minerals Yearbook 1998:Copper.* (2000 URL: http://minerals.er.usgs.gov/ minerals/pubs/commodity/copper/).

Eisler, Ronald. 1991. *Cyanide Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review.* U.S. Fish and Wildlife Service Biological Report 85 (1.23). Laurel, MD: U.S. Department of the Interior, Fish and Wildlife Service, Patuxent Wildlife Research Center.

Elmore, Wayne and Steve Leonard. 1998. Riparian manager and range ecologist, respectively, Bureau of Land Management Riparian Service Team, Prineville, OR. Personal communication.

Eng, R.L., E.J. Pitcher, S.J. Scott, and R.J. Greene. 1979. Minimizing the Effect of Surface Coal Mining on a Sage Grouse Population by a Directed Shift of Breeding Activities. In *The Mitigation Symposium: A National Workshop on Mitigating Losses of Fish and Wildlife Habitats*, G.A. Swanson, technical coordinator, pp. 464-468. General Technical Report RM-65. Ft. Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual.* Technical Report Y-87-1. Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station.

623

Environmental Resources Assessment Group. 1997. *Outdoor Recreation in the Western United States: Results from the National Survey on Recreation and the Environment.* Submitted to BLM. H. Ken Cordell, Project Leader. Athens, GA: USDA Forest Service, Southern Research Station.

EPA. See U.S. Environmental Protection Agency.

Evans, R.A. 1988. *Management of Pinyon-Juniper Woodlands.* General Technical Report INT-249. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Faanes, C.A. 1987. *Bird Behavior and Mortality in Relation to Power Lines in Prairie Habitats.* Fish and Wildlife Technical Report 7. Washington, D.C.: U.S. Department of the Interior, Fish and Wildlife Service.

Fahrig, L. 1997. Relative Effects of Habitat Loss and Fragmentation on Population Extinction. *Journal of Wildlife Management* 61(3):603-610.

Fahrig, L. and G. Merriam. 1994. Conservation of Fragmented Populations. *Conservation Biology* 8(1):50-59.

Farag, A.M., C.J. Boese, D.F. Woodward, and H.L. Bergman. 1994. Physiological Changes and Tissue Metal Accumulation in Rainbow Trout Exposed to Food-borne and Waterborne Metals. *Environmental Toxicology and Chemistry* 13:2021-2029.

Fenneman, N.M. 1931. *Phyisiography of the Western United States.* New York: McGraw-Hill.

_____. 1946. *Physical Divisions of the United States.* Prepared in cooperation with the Physiographic Committee of the U.S. Geological Survey. Washington, D.C.: U.S. Department of the Interior, Geological Survey.

Finlayson, B.J. and K.M. Verrue. 1980. Estimated Safe Zinc and Copper Levels for Chinook Salmon, *Oncorhynchus tshawytscha*, in the Upper Sacramento River, California. *California Fish and Game* 66(2):68-82.

Flack, S.R. and N.B. Benton. 1998. Invasive Species and Wetland Biodiversity. *National Wetlands Newsletter* 20(3):7-11.

Flather, Curtis H. and Hoekstra, Thomas W. 1989. *An Analysis of the Wildlife and Fish Situation in the United States: 1989-2040.* Ft. Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Forest Ecosystem Management Assessment Team (FEMAT). 1993. *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment, Report of the Forest Ecosystem Management Assessment Team.* Portland, OR and Washington, D.C.: U.S. Department of Agriculture, Forest Service.

Frazier Institute. 1998. *The Frazier Institute Survey of Mining Companies Operating in North America 1998/1999*. Vancouver, BC: The Frazier Institute.

_____. 1999. *The Frazier Institute Survey of Mining Companies Operating in North America 1999/2000*. Vancouver, BC: The Frazier Institute.

Freda, J., W.J. Sadinski, and W.A. Dunson. 1991. Long Term Monitoring of Amphibian Populations with Respect to the Effects of Acidic Deposition. *Water, Air, and Soil Pollution* 55:445-462.

Freddy, D.J., M.B. Whitcomb, and M.C. Fowler. 1986. Responses of Mule Deer to Disturbance by Persons Afoot and Snowmobiles. *Wildlife Society Bulletin* 14(1):63-68.

Freeman, A. Myrick. 1993. *The Measurement of Environmental and Resource Values: Theory and Methods*. Washington, D.C.: Resources for the Future.

FWS. See U.S. Department of the Interior, Fish and Wildlife Service.

Fyfe, R.W. and R.R. Olendorf. 1976. *Minimizing the Dangers of Studies to Raptors and Other Sensitive Species*. Canadian Wildlife Service Occasional Paper 23. Ottawa, Canada.

Gabrielsen, G.W. and E.N. Smith. 1995. Physiological Responses of Wildlife to Disturbance. In *Wildlife and Recreationists: Coexistence Through Management and Research*, edited by R.L. Knight and K.J. Gutzwiller, pp. 95-107. Washington, D.C.: Island Press.

GAO. See U.S. General Accounting Office.

Garrison, G.A., A.J. Bjugstad, D.A. Duncan, M.E. Lewis, and D.R. Smith. 1977. *Vegetation and Environmental Features of Forest and Range Ecosystems*. Agriculture Handbook No. 475. Washington, D.C.: U.S. Department of Agriculture, Forest Service.

Geist, V. 1978. *Life Strategies, Human Evolution, Environmental Design*. New York: Springer-Verlag.

Gentry, Donald W. 1998. Constrained Prospects of Mining's Future. *Mining Engineering 50* (June):85-94.

Gilbert, J., M.J. Dole-Oliver, P. Marmonier, and P. Vervier. 1990. Surface Water-Groundwater Ecotones. In *The Ecology and Management of Aquatic-Terrestrial Ecotones*, Vol. 4, edited by R.J. Naimen and H. Decamps, pp. 199-225. Paris: Parthenon Publishing Group.

Gold Fields Mineral Services. 2000. Precious Metals: Gold. *Engineering and Mining Journal* 201(3):33-34.

Grabert, V. 1998. Principal hydrologist, Luhdorff and Scalmanini Consulting Engineers, Woodland, CA. Personal communication.

Gregory, R.S. 1993. Effect of Turbidity on the Predator Avoidance Behavior of Juvenile Chinook Salmon *(Oncorhynchus tshawytscha). Canadian Journal of Fisheries and Aquatic Sciences* 50:241-246.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An Ecosystem Perspective of Riparian Zones. *BioScience* 41(8):540-551.

Gregory, S.V., G.A. Lamberti, D.C. Erman, K.V. Koski, M.L. Murphy, and J.R. Sedell. 1987. Influence of Forest Practices on Aquatic Production. In *Streamside Management: Forestry and Fishery Interactions*, edited by E.O. Salo and T.W. Cundy, pp. 233-255. Contribution no. 57. Seattle: University of Washington, Institute of Forest Resources.

Griffith, J.S. and D.A. Andrews. 1981. Effects of a Small Suction Dredge on Fishes and Aquatic Invertebrates in Idaho Streams. *North American Journal of Fisheries Management* 1:21- 28.

Guilbert, John M. and Charles Frederick Park. *The Geology of Ore Deposits*. New York: W.H. Freeman and Company.

Harris, C., G. Brown, and B. McLaughlin. 1995. *Rural Communities in the Inland Northwest, Characteristics of Small Towns in the Interior and Upper Columbia River Basins: An Assessment of the Past and Present.* Parts 1 and 2. Walla Walla, WA: Interior Columbia Basin Ecosystem Management Project.

Hartman, H.L. (editor). 1992. *SME Mining Engineering Handbook*. Littleton, CO: Society for Mining, Metallurgy and Exploration.

Harvey, B.C. 1986. Effects of Suction Gold Dredging on Fish and Invertebrates in Two California Streams. *North American Journal of Fisheries Management* 6:401-409.

Harvey, B.C. and T.E. Lisle. 1998. Effects of Suction Dredging on Streams: A Review and an Evaluation Strategy. *Fisheries* 23(8):8-17.

Haskins, Roger, Eugene Carlat, and Frederick B. Mullen. 1989. *Handbook for Mineral Examiners*. BLM Handbook H3890-1. Washington, D.C.: U.S. Department of the Interior, Bureau of Land Management.

Heath, Ralph C. 1984. *Ground-Water Regions of the United States*. Water Supply Paper 2242. Reston, VA: U.S. Department of the Interior, Geological Survey.

Hempel, Dwight. 1999. U.S. Department of the Interior, Bureau of Land Management, Military Liaison, Washington, D.C. Personal communication.

Henjum, M.G., J.R. Karr, D.L. Bottom, J.C. Perry, S.G. Bednarz, S.A. Wright, S.A. Beckwitt, E. Beckwitt. 1994. *Interim Protection for Late-Successional Forests Fisheries and Watersheds for National Forests East of the Cascade Crest in Oregon and Washington*. Eastside Forests Scientific Society Panel report to the Congress and President of the United States. Bethesda, MD: The Wildlife Society.

Henny, C J., R.J. Hallock, and E.F. Hill. 1994. Cyanide and Migratory Birds at Gold Mines in Nevada, USA. *Ecotoxicology* 3:45-58.

Hicks, B.J., J.D. Hall, P.A. Bisson, and J.R. Sedell. 1991. Responses of Salmonids to Habitat Change. *American Fisheries Society Special Publication* 19:483-518.

Higgins, P., S. Dobush, and D. Fuller. 1992. Factors in Northern California Threatening Stocks with Extinction. Unpublished report. Arcata, CA: American Fisheries Society, Humboldt Chapter.

Holthuijzen, A.M.A., W.G. Eastland, A.R. Ansell, M.N. Kochert, R.D. Williams, and L.S. Young. 1990. Effects of Blasting on Behavior and Productivity of Nesting Prairie Falcons. *Wildlife Society Bulletin* 18:270-281.

Horstman, A.J., J.R. Nawrot, and A. Woolf. 1998. Mine-Associated Wetlands as Avian Habitat. *Wetlands* 18(2):298-304.

Idaho State Conservation Effort. 1995. Habitat Conservation Assessment and Conservation Strategy for the Townsend's Big-Eared Bat. Draft unpublished Report No. 1. Boise, ID.

Ingersoll, C.G., W.G. Brumbaugh, F.J. Dwyer, and N.E. Kemble. 1994. Bioaccumulation of Metals by *Hyalella azteca* Exposed to Contaminated Sediments from the Upper Clark Fork River, Montana. *Environmental Toxicology and Chemistry* 13:2013-2020.

INTER-FLUVE, Inc. 1991. *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana*. Prepared for the U.S. Environmental Protection Agency, Region VIII, Helena, MT. Bozeman, MT: INTER-FLUVE, Inc.

Ireland, T.T., G.L. Wolters, and S.D. Schemnitz. 1994. Recolonization of Wildlife on a Coal Strip-mine in Northwestern New Mexico. *Southwestern Naturalist* 39(1):53-57.

James, L.A. 1989. Sustained Storage and Transport of Hydraulic Gold Mining Sediment in the Bear River, California. *Annals of the Association of American Geographers* 79:570-592.

_____. 1991. Incision and Morphologic Evolution of an Alluvial Channel Recovering from Hydraulic Mining Sediment. *Geological Society of America Bulletin* 103:723-736.

JBR Environmental Consultants Inc. 1997. *Draft Marigold Mining Company EIS Baseline Reports*. Elko, NV.

Johns, C. and J. Moore. 1985. Copper, Zinc and Arsenic in Bottom Sediments of Clark Fork River Reservoirs: Preliminary Findings. In *Proceedings, Clark Fork River Symposium*, edited by C.E. Carlson and L.L. Bahls, pp 74-88. Butte: Montana Academy of Sciences and Montana College of Mineral Science and Technology.

K-III Directory Corporation. 1997. *Rental Rate Blue Book for Construction Equipment*. San Jose, CA: K-III Directory Corporation, Machinery Information Division.

Kemble, N.E., W.G. Brumbaugh, E.L. Brunson, F.J. Dwyer, C.G. Ingersoll, D.P. Monda, and D.F. Woodward. 1994. Toxicity of Metal-contaminated Sediments from the Upper Clark Fork River, Montana, to Aquatic Invertebrates and Fish in Laboratory Exposure. *Environmental Toxicology and Chemistry* 13:1985-1997.

Kershaw, Byard. 2000. Geologist, Bureau of Land Management, Arizona State Office, Phoenix, AZ. Personal communication.

Kimball, B.A., E. Callender, and E.V. Axtmann. 1995. Effects of Colloids on Metal Transport in a River Receiving Acid Mine Drainage, Upper Arkansas River, Colorado, U.S.A. *Applied Geochemistry* 10:285-306.

Kleinman, R.L.P. 1989. Acid Mine Drainage. *Engineering and Mining Journal* 190(7):16L-16N.

Klotz, R.L. and E.A. Matson. 1978. Dissolved Organic Carbon Fluxes in the Shetucket River of Eastern Connecticut, U.S.A. *Freshwater Biology* 8:347-355.

Kondolf, G.M., G.F. Cada, M.J. Sale, and T. Felando. 1991. Distribution and Stability of Potential Salmonid Spawning Gravels in Steep Bouldery Streams of the Eastern Sierra Nevada. *Transactions of the American Fisheries Society* 120:177-186.

Kovalchik, B.L. and W. Elmore. 1992. Effects of Cattle Grazing Systems on Willow-Dominated Plant Associations in Central Oregon. In *Proceedings-Symposium on Ecology and Management of Riparian Shrub Communities*, edited by W.P. Clary, E.D. McArthur, D. Bedunah, and C.L. Wambolt, pp. 111-120. General Technical Report INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Kral, Steve. 1997. Gold Market Trends in Colorado Mining Association Celebrates Its Centennial. *Mining Engineering*, 49 (April): 40-43.

Kuck, L. 1986. The Impacts of Phosphate Mining on Big Game in Idaho: A Cooperative Approach to Conflict Resolution. *Transactions of the 51st North American Wildlife and Natural Resources Conference* 51:90-97.

Kuck, L., G.L. Hompland, E.H. Merrill. 1985. Elk Calf Response to Simulated Mine Disturbance in Southeast Idaho. *Journal of Wildlife Management* 49(3):751-757.

Leaming, George F. 1997. *Mining and the American Economy*. Western Economic Analysis Center. Washington, D.C.: National Mining Association.

Lee, R.G., M.S. Carroll, and K.K. Warren. 1991. The Social Impacts of Timber Harvest Reductions in Washington State. In *Revitalizing the Timber Dependent Regions of Washington*, edited by P. Sommers and H. Birss, pp. 3-1 - 3-19. Seattle: University of Washington, Northwest Policy Center.

Leopold, L.B. 1994. A *View of the River*. Cambridge, MA: Harvard University Press.

Li, H.W. 1995. Non-Native Species. In: *Our Living Resources: a Report to the Nation on the Distribution, Abundance, and Health of U.S. Plants, Animals, and Ecosystems*, edited by E.T. LaRoe, G.S. Farris, C.E. Puckett, P.D. Doran., and M.J. Mac, pp. 427-428. Washington, D.C.: U.S. Department of the Interior, National Biological Service.

Lipton, J., H. Galbraith, and K. LeJeune. 1993. *Terrestrial Resources Injury Assessment Report. Upper Clark Fork River Basin*. Boulder, CO: RCG/Hagler, Bailly, Inc.

Lloyd, D.S., J.P. Koenings, and J.D. LaPerriere. 1987. Effects of Turbidity in Fresh Waters of Alaska. *North American Journal of Fisheries Management* 7:18-33.

Lowther, P.E. 1993. Brown-Headed Cowbird. In *The Birds of North America*, No 47, edited by A. Poole and F. Gill, pp. 1-23. Philadelphia: The American Ornithologists' Union, Academy of Natural Sciences of Philadelphia.

MacArthur, R.A., V. Geist, and R.H. Johnston. 1982. Cardiac and Behavioral Responses of Mountain Sheep to Human Disturbance. *Journal of Wildlife Management* 46(2):351-358.

Macdonald, M.S., G. Miller, and W.B. Lyons. 1994. *Water Quality in Open Pit Precious Metal Mines*. Final report for Grant #R820245, EPA Report No. 530-R-95-011. Reno, NV: University of Nevada, Reno, Department of Environmental and Resource Sciences.

Mackey R.L. and R.M.R. Barclay. 1989. The Influence of Physical Clutter and Noise on the Activity of Bats over Water. *Canadian Journal of Zoology* 67:1167-1170.

Madison, R.J. 1981. *Effects of Placer Mining on Hydrologic Systems in Alaska: Status of Knowledge*. BLM-Alaska Technical Report 7. Anchorage, AK: U.S. Department of the Interior, Bureau of Land Management.

Manning, R. 1994. Going for the Gold. *Audubon* 96:68-74.

Maurer, Douglas K., Russell W. Plume, James M. Thomas, and Ann K. Johnson. 1996. *Water Resources and Effects of Changes in Ground-Water Use Along the Carlin Trend, North-Central Nevada*. U.S. Geological Survey Water Resource Investigations Report 96-4134. Prepared in cooperation with the Nevada Division of Water Resources. Denver: U.S. Department of the Interior, Geological Survey.

McCarthy, M.A., D.B. Lindenmayer, and M. Drechsler. 1997. Extinction Debts and Risks Faced by Abundant Species. *Conservation Biology* 11(1):221-226.

McClain, Holli. 1998. Outdoor Recreation Planner, Northern Field Office, Fairbanks, AK. Personal communication.

McCulloch, R., B. Ihie, V. Ciliberti, and M. Williams. 1993. *Montana Placer Mining BMPs (Best Management Practices): Guidelines for Planning, Erosion Control, and Reclamation.* Special Publication 106. Butte, MT: Montana Bureau of Mines and Geology.

McDowell, W.H. and S.G. Fisher. 1976. Autumnal Processing of Dissolved Organic Matter in a Small Woodland Stream Ecosystem. *Ecology* 57:561-569.

629

McElfish , J.M. Jr., T. Bernstein, S.P. Bass, and E. Sheldon. 1996. *Hard Rock Mining: State Approaches to Environmental Protection*. Washington, D.C.: Environmental Law Institute.

McKee, T.B., N.J. Doesken, F.M. Smith, and J.D. Kleist. 1981. Climatological Analysis for Mined-Land Reclamation. Denver, CO: Bureau of Land Management, Division of Special Studies.

McKinstry M.C. and S.H. Anderson. 1994. Evaluation of Wetland Creation and Waterfowl Use in Conjunction with Abandoned Mine Lands in Northeast Wyoming. *Wetlands* 14(4):284-292.

Meehan, W.R. 1991. *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats*. Special Publication 19. Bethesda, MD: American Fisheries Society.

Mehringer, P. and P.E. Wigand. 1987. Western Juniper in the Holocene. In *Proceedings Pinyon-Juniper Conference*, 109-119. General Technical Report INT-215. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Merrill, E.H., T.P. Hemker, K.P. Woodruff, and L. Kuck. 1994. Impacts of Mining Facilities on Fall Migration of Mule Deer. *Wildlife Society Bulletin* 22:68-73.

Michel, B. 1971. *Winter Regime of Rivers and Lakes*. Monograph III-B1a. Hanover, NH: U.S. Army Corps of Engineers, Cold Regions Science and Engineering Laboratory.

Miller, G.C., W.B. Lyons, and A. Davis. 1996. Water Quality of Pit Lakes. *Environmental Science and Technology* 30(3):118-123.

Mining Engineering. 1999. Exploration Spending Declines 31% in 1998. *Mining Engineering* 51(12):8.

Molini, William A. 1998. Letter to "Dear Interested Party" from the Administrator of the Nevada Department of Conservation and Natural Resources, Division of Wildlife, June 30, 1998. Reno, NV.

Montana Department of State Lands; U.S. Department of Agriculture, Forest Service; and Montana Department of Health and Environmental Sciences. 1992. *East Boulder Mine Project Final Environmental Impact Statement*. Helena, MT: Montana Department of State Lands.

Moore, J.N., S.N. Luoma, and D. Peters. 1991. Downstream Effects of Mine Effluent on an Intermontane Riparian System. *Canadian Journal of Fisheries and Aquatic Science* 48:222-232.

Moran, R. 1998. *Cyanide Uncertainties: Observations on the Chemistry, Toxicity, and Analysis of Cyanide in Mining-Related Waters*. Washington, D.C.: Mineral Policy Center.

Mory, Peter. 1998. Industrial Specialist, U.S. Department of Defense, Defense Logistics Agency, Defense National Stockpile Center. Personal communication.

Mueggler, W.F. and W.L. Stewart. 1980. *Grassland and Shrubland Habitat Types of Western Montana.* General Technical Report INT-66. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Mullen, G. 1994. Montana Department of Health and Environmental Services (DHES). Personal communication with C. Paulsen, November 18. In U.S. Department of the Interior, Bureau of Land Management, Lewistown District Office and Montana Department of Environmental Quality, Hard Rock Bureau. 1996. *Zortman and Landusky Mines Reclamation Plan Modifications and Mine Life Extensions Final Environmental Impact Statement*. Lewistown, MT: Bureau of Land Management, Lewistown District Office.

Murphy, M.L. and W.R. Meehan. 1991. Stream Ecosystems. In *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats*, edited by W.R. Meehan, pp. 17-46. American Fisheries Society Special Publication 19. Bethesda, MD: American Fisheries Society.

Murray, Stuart. 1997. Gold. *Engineering and Mining Journal* 198 (March):13-17.

_____. 1998. Gold. *Engineering and Mining Journal* 199 (March):35-38.

National Research Council. 1979. *Surface Mining of Non-Coal Minerals: A Study of Mineral Mining from the Perspective of the Surface Mining Control and Reclamation Act.* Washington, D.C.: National Academy of Sciences, Board on Mineral and Energy Resources, Commission on Natural Resources.

_____. 1981. *Surface Mining: Soil, Coal, and Society*. Washington, D.C.: National Academy Press.

_____. 1992. *Restoration of Aquatic Ecosystems*. Washington, D.C.: National Academy Press.

Nehlsen, W. 1996. Pacific Salmon Status and Trends–A Coastwide Perspective. In *Pacific Salmon and Their Ecosystems: Status and Future Options*, edited by D.J. Stouder, P.A. Bisson, and R.J. Naiman, pp 41-50. New York: Chapman and Hall.

Nehlsen, W., J.E. Williams, and J.A. Lichatowich. 1991. Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington. *Fisheries* 16(2):4-21.

Netcher, Dan. 1998. Geologist, Bureau of Land Management, Ely Field Office, Ely, NV. Personal communication.

Nickelson, T.E., J.W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser, and S.E. Jacobs. 1992. *Status of Anadromous Salmonids in Oregon Coastal Basins*. Portland: Oregon Department of Fish and Wildlife.

North Carolina State University. 1998. Successful Mitigation. Internet website at http://h20sparc.wq.ncsu.edu/info/wetlands/. Raleigh, NC: North Carolina State University Cooperative Extension Service, Department of Biological and Agricultural Engineering.

Noss, R.F., H.B. Quigley, M.G. Hornocker, T. Merrill, and P.C. Paquet. 1996. Conservation Biology and Carnivore Conservation in the Rocky Mountains. *Conservation Biology* 10(4):949-963.

NPS. See U.S. Department of the Interior, National Park Service.

NRC. See Committee on Hardrock Mining on Federal Lands; Committee on Earth Resources; Board on Earth Sciences and Resources; Commission on Geosciences, Environment, and Resources; National Research Council.

Orth, D.J. and R.J. White. 1993. Stream Habitat Management. In *Inland Fisheries Management in North America*, edited by C.C. Kohler and W.A. Hubert, pp.205-230. Bethesda, MD: American Fisheries Society.

Overcash, M.R. and D. Pal. 1979. *Design of Land Treatment Systems for Industrial Waste–Theory and Practice*. Ann Arbor, MI: Ann Arbor Science.

Page, L.M. and B.M.. Burr. 1991. *A Field Guide to Freshwater Fishes*. Boston: Houghton Mifflin.

Partners in Flight. 1998. *Birds as Indicators of Riparian Vegetation Condition in the Western United States*. Boise, ID: U.S. Department of the Interior, Bureau of Land Management, Idaho State Office.

Pastor, J. and C.A. Johnston. 1992. Using Simulation Models and Geographic Information Systems to Integrate Ecosystem and Landscape Ecology. In *Watershed Management: Balancing Sustainability and Environmental Change*, edited by R.J. Naiman, pp. 324- 346. New York: Springer-Verlag.

Pinay, G., H. Decamps, E. Chauvet, and E. Fustec. 1990. In *The Ecology and Management of Aquatic-Terrestrial Ecotones*, Vol. 4, edited by R.J. Naimen and H. Decamps, pp. 141-169. Paris: Parthenon Publishing Group.

Planert, M., and John S. Williams. 1995. *Ground Water Atlas of the United States, Segment 1, California, Nevada*. USGS Hydrologic Investigations Atlas 730-B. Reston, VA: U.S. Department of the Interior, Geological Survey.

Postovit, H.R. and B.C. Postovit. 1987. Impacts and Mitigation Techniques. In *Raptor Management Techniques Manual*, edited by B.A. Giron Pendleton, B.A. Millsap, K.W. Cline, and D.M. Bird, pp. 183-213. Washington, D.C.: National Wildlife Federation.

Quigley, T.M., K. Lee, and S.J. Arbelbide (technical editors). 1997. *Evaluation of EIS Alternatives by the Science Integration Team/Ecosystem Management in the Interior Columbia River Basin*. General Technical. Report 406. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Ramakka, J.M. 1988. Impacts and Mitigation of Mineral Development on Raptors in the Southwest. In *Proceedings of the Southwest Raptor Management Symposium and Workshop*, edited by R.L. Glinski and others, pp. 335-340. Washington, D.C.: National Wildlife Federation.

Reed, R.A., J. Johnson-Barnard, and W.L. Baker. 1996. Contribution of Roads to Forest Fragmentation in the Rocky Mountains. *Conservation Biology* 10(4):1098-1106.

Reutter, D. and P. Brinckerhoff. 1998. Does Wetland Mitigation Work in the Long-Term? *Land and Water* 42:47-48.

Ricciardi A., and J.B. Rasmussen. 1998. Predicting the Identity and Impact of Future Biological Invaders: A Priority for Aquatic Resource Management. *Canadian Journal of Fisheries and Aquatic Sciences* 55:1759-1765.

Rich, Terry and Carol Beardmore. 1997. *Priority Bird Species in the Western U.S.: 177 Species on the List of One or More States, October 10, 1997.* Partners In Flight Western Working Group. Boise, ID: U.S. Department of the Interior, Bureau of Land Management.

Robinson, Scott K. 1992. Population Dynamics of Breeding Neotropical Migrants in a Fragmented Illinois Landscape. In *Ecology and Conservation of Neotropical Migrant Landbirds*, edited by J.M. Hagan III and D.W. Johnson, pp. 408-418. Washington, D.C.: Smithsonian Institution Press.

Robinson, Scott K., F.R. Thompson III, T.M. Donovan, D.R. Whitehead, and J. Faaborg. 1995. Regional Forest Fragmentation and the Nesting Success of Migratory Birds. *Science* 267:1987-1990.

Robinson, Scott K., J.P. Hoover, J.R. Herkert, and R. Jack. 2000. Cowbird Parasitism in a Fragmented Landscape: Effects of Tract Size, Habitat, and Abundance of Cowbirds and Hosts. In *Ecology and Management of Cowbirds and Their Hosts: Studies in the Conservation of North American Passerine Birds*, edited by James N.M. Smith, Scott K. Robinson, and Stephen I. Rothstein. Austin: University of Texas Press.

Robson, S.G. and E.R. Banta. 1995. *Ground Water Atlas of the United States, Segment 2, Arizona, Colorado, New Mexico, Utah.* USGS Hydrologic Atlas 730-C. Reston, VA: U.S. Department of the Interior, Geological Survey.

Roelofs, T.D, 1983. Current Status of California Summer Steelhead, *Salmo gairdneri*, Stocks and Habitat, and Recommendations for Their Management. Final report to U.S. Department of Agriculture, Forest Service, Region 5. San Francisco.

Roper Starch Worldwide. 1997. *The National Report Card on Environmental Knowledge, Attitudes, and Behaviors: The Sixth Annual Survey of Adult Americans.* Washington, D.C.: National Environmental Education and Training Foundation.

Rosgen, David L. 1996. *Applied River Morphology.* Pagosa Springs, CO: Wildland Hydrology.

Ross, Christopher. 1996. *Revegetation of Mined Lands in Nevada, the State of the Art in the Arid Zone*. Reno, NV: U.S. Department of the Interior, Bureau of Land Management, Nevada State Office.

SBA: See Small Business Administration.

Schafer, W.M. 1984. Minesoil Restoration and Maturity: A Guide for Managing Minesoil Development. In *Proceedings: Symposium on Surface Coal Mining and Reclamation in the Great Plains*, pp 172-185. Bozeman, MT: Montana State University.

Schantz, R. and R. Adams. 1990. *Minerals in the East Mojave National Scenic Area, California: An Economic Analysis Volume II*. Bureau of Mines report MLA-6-90. Washington, D.C.: U.S. Department of the Interior, Bureau of Mines.

Schmitz, D.C. and D. Simberloff. 1997. Biological Invasions: A Growing Threat. *Issues in Science and Technology* 13(4):33-40.

Scott, M.D. and G.M. Zimmerman. 1984. Wildlife Management at Surface Coal Mines in the Northwest. *Wildlife Society Bulletin* 12:364-370.

Sedell, J.R. and R.L. Beschta. 1991. Bringing Back the "Bio" in Bioengineering. *American Fisheries Society Symposium* 10:160-175.

Sedell, J.R., G.H. Reeves, F.R. Hauer, [and others]. 1990. Role of Refugia from Disturbances: Modern Fragmented and Disconnected River Systems. *Environmental Management* 14(5):711-724.

Shaw, W. Douglass, Noelwah Netusil, Marlene Rebori, Loretta Singletary, Eric Huszar, and Cari Leversee. 1997. Can Research Reach Out?: The Potential Impacts of Mine Dewatering in the Humboldt River Basin, Nevada. Draft. Reno, NV: University of Nevada, Reno, Department of Applied Economics and Statistics.

Shaw, E.A.G. 1978. Symposium on the Effects of Noise on Wildlife. In: *Effects of Noise on Wildlife*, edited by J.L. Fletcher and R.G. Busnel, pp.1-5. New York: Academic Press.

Shaw, R.B., and V.E. Diersing. 1990. Tracked Vehicle Impacts on Vegetation at the Piñon Canyon Maneuver Site, Colorado. *Journal of Environmental Quality* 19:234-243.

Sibbing, J. M. 1997. Mitigation's Role in Wetland Loss. *National Wetlands Newsletter* 19(1):17-21.

Silva, Enrique R. 2000. Copper. *Engineering and Mining Journal* 201(March):21-23.

Slaughter, C.W. 1990. *Aufeis Formation and Prevention*. Cold Regions Hydrology and Hydraulics. Technical Council on Cold Regions Engineering Monograph. Fairbanks, AK: U.S. Department of Agriculture, Forest Service.

Small Business Administration. 1998. *The Regulatory Flexibility Act: An Implementation Guide for Federal Agencies*. Washington, D.C.

SME. 1998. *Remediation of Historical Mine Sites - Technical Summaries and Bibliography.* Littleton, CO: Society for Mining, Metallurgy and Exploration.

Smith, Stephen D. 1999. Minerals Information Team, U.S. Department of the Interior, Geological Survey. Statistical Summary. (2000 URL: http://minerals.er.usgs.gov/minerals/pubs/commodity/statistical_ summary/index.html#myb).

Soulé, M.E. (editor). 1986. *Conservation Biology: The Science of Scarcity and Diversity.* Sunderland, MA: Sinauer Press.

_____. 1990. The Onslaught of Alien Species and Other Challenges in the Coming Decades. *Conservation Biology* 4:233-239.

Stanford, J.A. and J.V. Ward. 1988. The Hyporheic Habitat of Riverine Ecosystems. *Nature* 335:64-66.

Stankey, George, and Roger Clark. 1991. *Social Aspects of New Perspectives in Forestry: A Problem Analysis.* Consortium for the Social Values of Natural Resources, supported by Oregon State University and U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Millford, PA: Grey Towers Press.

Stanton, M.D., T.A. Colbert, and R.B. Trenholme. 1986. Environmental Handbook for Cyanide Leaching Projects. In *Manual for Reviewing Proposed Cyanide Leaching Projects.* Denver, CO: U.S. Department of the Interior, National Park Service, Energy, Mining, and Minerals Division.

Stephenson, T.R., M.R. Vaughan, and D.E. Andersen. 1996. Mule Deer Movements in Response to Military Activity in Southeast Colorado. *Journal of Wildlife Management* 60(4):777- 787.

Stouder, D.J., P.A. Bisson, and R.J. Naiman. 1997. *Pacific Salmon and Their Ecosystems.* New York: Chapman and Hall.

Street, B. 1998. Improving Mitigation Performance: Results from a Maryland Study. *National Wetlands Newsletter* 20(5):11-13.

Stussy, R.J., W.D. Edge, and T.A. O'Neil. 1994. Survival of Resident Elk in the Cascade Mountains of Oregon. *Wildlife Society Bulletin* 22:242-247.

Swanson, C.D. and R.W. Bachmann. 1976. A Model of Algal Exports in Some Iowa Streams. Ecology 57:1076-1080.

Swanston, D.N. 1991. *Natural Processes.* American Fisheries Society Special Publication 19:139179. Bethesda, MD: National Fisheries Society.

Tate, J. Jr., M.S. Boyce, and T. R. Smith. 1979. Response of Sage Grouse to Artificially Created Display Grounds. In *The Mitigation Symposium: A National Workshop on Mitigating Losses of Fish and Wildlife Habitats,* G.A. Swanson, technical coordinator, pp. 459-463. General Technical Report RM-65. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Thomas, V.G. 1985. Experimentally Determined Impacts of a Small, Suction Gold Dredge on a Montana Stream. *North American Journal of Fisheries Management* 5:480-488.

Tilton, John E. and Hans H. Landsberg, 1997. *Innovation, Productivity Growth, and the Survival of the U.S. Copper Industry*. Discussion Paper 97-41. Washington, D.C.: Resources for the Future.

Treiman, Evelyn. 1998. Outdoor recreation planner, Bureau of Land Management, Elko Field Office, Elko, NV. Personal communication.

Tuttle, M.D. and D.A.R. Taylor. 1994. *Bats and Mines*. Resource Publication No. 3. Austin, TX: Bat Conservation International, Inc.

USBM. See U.S. Department of the Interior, Bureau of Mines.

U.S. Department of Agriculture, Forest Service. 1990. ROS: *Primer and Field Guide*. Leaflet R6REC-021-90. Washington, D.C.: U.S. Department of Agriculture, Forest Service.

_____. 1993a. Acid Mine Drainage from Mines on the National Forests, a Management Challenge. Program Aid 1505. In U.S. Environmental Protection Agency (1994) *Acid Mine Drainage*, p. 12. Washington, D.C.: U.S. Department of Agriculture, Forest Service.

_____. 1993b. *Micro IMPLAN User's Guide*. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Land Management Planning Systems Group.

_____. 1996. *Energy and Minerals Industries in National, Regional, and State Economies*. General Technical Reposrt FPL-GTR-95. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory.

U.S. Department of Agriculture, Forest Service and U.S. Department of the Interior, Bureau of Land Management. 1998. *Economic and Social Conditions of Communities: Economic and Social Characteristics of Interior Columbia Basin Communities and an Estimation of Effects on Communities from the Alternatives of the Eastside and Upper Columbia River Basin Draft Environmental Impact Statements*. Walla Walla, WA: Interior Columbia Basin Ecosystem Management Project.

U.S. Department of Commerce, Bureau of Economic Analysis.1999. Regional Economic Information System (REIS). Washington, D.C.

_____. 2000. *Survey of Current Business*. April 2000. Washington D.C.

U.S. Department of Commerce, Bureau of the Census. 1996a. *1992 Census of Mineral Industries. Geographic Area Series, Mountain States*. MIC92-A-8. Washington, D.C.: Government Printing Office.

_____. 1996b. *1992 Census of Mineral Industries. Geographic Area Series, Pacific States*. MIC92-A-9. Washington, D.C.: Government Printing Office.

636

_____. 1996c. *1992 Census of Mineral Industries. Industry Series, Copper Ores, Lead and Zinc Ores, Gold Ores, and Silver Ores*. MIC92-1-10B. Washington, D.C.: Government Printing Office.

_____. 1996d. *1992 Census of Mineral Industries. Industry Series, Ferroalloy Ores, Metal Mining Services, and Miscellaneous Metal Ores*. MIC92-1- 10C. Washington, D.C.: Government Printing Office.

_____. 1997. *Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations. First Quarter 1997*. Series QFR/97-1. Washington, D.C.: Government Printing Office.

U.S. Department of Commerce, Bureau of the Census, Foreign Trade Division. 2000. *U.S. International Trade in Goods and Services January 1998 to May 2000. May 2000*. Report FT900 (CB-00-109). Washington, D.C.

U.S. Department of Defense, Defense Logistics Agency. Various years. *Strategic and Critical Materials Report to the Congress*. Fort Belvoir, VA: Defense Logistics Agency.

U.S. Department of the Interior, 1993. *Economic Implications of a Royally System for Hardrock Minerals*. Washington, D.C.

_____. 1998. Benefit-Cost Analysis/Unfunded Reform Act Analysis, Proposed DOI Rulemaking Subpart 3809–Surface Management, December 22, 1998. Washington, D.C.

_____. 2000. Benefit-Cost Analysis/Unfunded Mandates Reform Analysis, and Final Small Business and Regulatory Flexibility Act Analysis. DOI Rulemaking Subpart 3809–Surface Management. Washington, D.C.

U.S. Department of the Interior, Bureau of Land Management. 1979. *Public Land Statistics 1978*. Washington, D.C.: Government Printing Office.

_____. 1980. *Final Environmental Impact Statement Surface Management of Public Lands under the U.S. Mining Laws 43 CFR 3809*. Washington, D.C.

_____. 1986. Visual Resource Inventory, BLM Manual Handbook 8410-1, January 17, 1986. Washington, D.C.

_____. 1988a. *Birch Creek Placer Mining Final Cumulative Environmental Impact Statement*. Anchorage, AK: BLM Alaska State Office

_____. 1988b. *Beaver Creek Placer Mining Final Cumulative Environmental Impact Statement*. Anchorage, AK: BLM Alaska State Office.

_____. 1988c. *Cody Resource Area, Worland District, Wyoming, Proposed Resource Management Plan/Final Environmental Impact Statement*. Worland, WY: BLM Worland District.

_____. 1988d. *Fortymile River Placer Mining: Final Cumulative Environmental Impact Statement*. Anchorage, AK: BLM Alaska State Office.

_____. 1988e. *Minto Flats Placer Mining: Draft Cumulative Environmental Impact Statement.* Anchorage, AK: BLM Alaska State Office.

_____. 1991a. *Special Status Fishes Habitat Management.* Washington, D.C.

_____. 1991b. *Riparian-Wetland Initiative for the 1990's.* Washington, D.C.

_____. 1992a. *1872 Mining Law Operation 3809 Surface Management Regulation Review Task Force Findings and Analysis.* Washington, D.C.

_____. 1992b. *Solid Minerals Reclamation Handbook.* BLM Manual Handbook H-3042- 1. Washington, D.C.

_____. 1993a. *Resident Fish Habitat Management.* Denver, CO: BLM Service Center.

_____. 1993b. *Riparian Area Management: Process for Assessing Proper Functioning Condition.* Technical Reference 1737-9. Denver, CO: U.S. Department of the Interior, Bureau of Land Management, Service Center.

_____. 1994a. *Rangeland Reform '94. Draft Environmental Impact Statement.* Washington, D.C.

_____. 1994b. *Process for Assessing Proper Functioning Condition for Lentic Riparian-Wetland Areas.* Technical Reference 1737-11. Denver, CO: BLM Service Center.

_____. 1994c. *Stone Cabin Mine Final Environmental Impact Statement.* Boise, ID: BLM Boise District.

_____. 1995a. *Process for Assessing Proper Functioning Condition.* Technical Reference 1737-9, Revised. Denver, CO: BLM Service Center.

_____. 1995b. *Lone Tree Mine Expansion Project Draft Environmental Impact Statement.* Winnemucca, NV: BLM Winnemucca District Office.

_____. 1996a. *Management of Anadromous Fish Habitat on Public Lands; Including Sustainable Management Concepts, and Status and Trends in Alaska, Coastal, and Columbia Regions.* Washington, D.C.

_____. 1996b. Recreational Fishery *Resources Conservation Plan Implementation Strategy.* Final Draft. Washington, D.C.

_____. 1996c. *Bootstrap Project Draft Environmental Impact Statement.* Elko, NV: BLM Elko District Office.

_____. 1996d. *Final Environmental Impact Statement Twin Creeks Mine.* Winnemucca, NV: BLM Winnemucca District Office.

_____. 1997a. 43 *CFR 3809 Surface Management Regulations - Scoping Report.* Washington, D.C.

_____. 1997b. *Public Land Statistics 1996*. Volume 181. Denver: BLM Business Center.

_____. 1998a. *Public Land Statistics 1997*. Volume 182. Denver: BLM Business Center.

_____. 1998b. Visual Resources Management Policy Restatement. Information Bulletin No. 98-135. Washington, D.C.

_____. 1998c. *Riparian-Wetland Initiative for the 1990's: Report of Accomplishments for Fiscal Year 1997*. Washington, D.C.

_____. 1998d. Backfilling of Open Mining Pits in Nevada. Nevada State Office memorandum, October 9, 1998. Reno, NV: BLM Nevada State Office.

_____. 1999a. *Public Land Statistics 1998*. Volume 183. Denver: BLM Business Center.

_____. 1999b *Surface Management Regulations for Locatable Mineral Operations Draft Environmental Impact Statement*. Washington, D.C.: BLM Washington Office.

_____. 1999c. *43 CFR 3809 Surface Management Regulations Interim Content Analysis Report*. Washington, D.C.: BLM Washington Office.

_____. 2000a. *Public Land Statistics 1999*. Volume 184. Denver: BLM Business Center.

U.S. Department of the Interior, Bureau of Land Management, Lewistown District Office and Montana Department of Environmental Quality, Hard Rock Bureau. 1996. *Zortman and Landusky Mines Reclamation Plan Modifications and Mine Life Extensions Final Environmental Impact Statement*. Lewistown, MT: BLM Lewistown District Office.

U.S. Department of the Interior, Bureau of Land Management, Montana State Office and U.S. Department of Agriculture, Forest Service, Northern Region. 1997. *Environmental Impact Statement for the Proposed Cooke City Area Mineral Withdrawal*. Billings, MT: BLM Montana State Office.

U.S. Department of the Interior, Bureau of Mines. 1981. Copper. *Mineral Commodity Summaries* Various years. Washington, D.C.: Government Printing Office.

U.S. Department of the Interior, Fish and Wildlife Service. 1990. Penalties in Nevada Bird Deaths at Gold Mine Announced by U.S. Attorney in Nevada. News Release, March 22. Portland, OR: U.S. Fish and Wildlife Service, Region 1.

U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, Bureau of the Census. 1997. *1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*. Washington, D.C.: U.S. Fish and Wildlife Service.

U.S. Department of the Interior, Geological Survey. 1986. *National Water Summary, 1985: Hydrologic Events and Surface Water Resources*. Water Supply Paper 2300. Washington, D.C.: Government Printing Office.

_____. 1988. *National Water Summary, 1986: Hydrologic Events and Ground-Water Quality.* Water Supply Paper 2325. Washington, D.C.: Government Printing Office.

_____. 1993. *National Water Summary, 1990-91.* Water Supply Paper 2400. Washington, D.C.

_____. 1998. Gold. *Mineral Commodity Summaries 1998.* Reston, VA: USGS Eastern Region.

_____. Various years (a). *Mineral Commodity Summaries.* Reston, VA: USGS Eastern Region.

_____. Various years (b). *Mineral Industry Summaries.* Reston, VA: USGS Eastern Region.

_____. 2000. Copper. *Mineral Industry Surveys.* Reston: VA: USGS.

U.S. Department of the Interior, National Park Service. 2000. PSD Class I Area Boundary Files' FTP Site (ftp://ftp.nps.gov/pub/park_boundaries) Published at the "AirWeb NPS Parks and FWS Refuges" Internet website (http://www2.nature.nps.gov/ard/ parkhp.html).

USDI. See U.S. Department of the Interior.

U.S. Environmental Protection Agency. 1985. Report to Congress: *Wastes from the Extraction and Beneficiation of Metallic Ores, Phosphate Rock, Asbestos, Overburden from Uranium Mining, and Oil Shale.* Report 530-SW85-033. Washington, D.C.: EPA Office of Solid Waste and Emergency Response.

_____.1986. *Quality Criteria for Water.* EPA-440/5- 86-001. Washington, D.C.: EPA Office of Regulations and Standards.

_____. 1991. *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana.* Helena, MT: EPA Region 8, Montana Operations Office.

_____. 1996. Seminar Publication: *Managing Environmental Problems at Inactive and Abandoned Metals Mine Sites.* Report 625-R-95-007. Washington, D.C.: EPA Office of Research and Development.

_____. 1997. EPA's *National Hardrock Mining Framework.* Report 833-13-97-003. Washington, D.C.

_____. 1998. *Clean Water Action Plan: Restoring and Protecting America's Waters.* EPA-840-R-98-001. Washington, D.C.: EPA Center for Environmental Publications and Information.

_____. 1999a. *Ground Water Report to Congress: Report for Section 1429 of the Safe Drinking Water Act.* Washington, D.C.: EPA Office of Water.

_____. 1999b. *Economic Impact Analysis of Final Effluent Limitations Guidelines and Standards for the Gold Placer Mining Industry.* Washington, D.C.

USFS. See U.S. Department of Agriculture, Forest Service.

U.S. General Accounting Office. 1986. *Public Lands: Interior Should Ensure Against Abuses from Hardrock Mining*. GAO/RCED-86-48. Washington, D.C.

_____. 1987a. *Federal Land Management: Financial Guarantees Encourage Reclamation of National Forest System Lands*. GAO/RCED-87-157. Washington, D.C.

_____. 1987b. *Federal Land Management: Limited Action Taken to Reclaim Hardrock Mine Sites*. GAO/RCED-88-21. Washington, D.C.

_____. 1988. *Federal Land Management: An Assessment of Hardrock Mining Damage*. GAO/RCED-88-123. Washington, D.C.

_____. 1989. *Federal Land Management: The Mining Law of 1872 Needs Revision*. GAO/RCED-89-72. Washington, D.C.

_____. 1990. *Federal Land Management: Unauthorized Activities Occurring on Hardrock Mining Claims*. GAO/RCED-90-111. Washington, D.C.

_____. 1991a. *Mineral Resources: Increased Attention Being Given to Cyanide Operations*. GAO/RCED-91-145. Washington, D.C.

_____. 1991b. *Public Land Management: Attention to Wildlife is Limited*. GAO/RCED-91-64. Washington, D.C.

_____. 1992. *Mineral Resources: Value of Hardrock Minerals Extracted from and Remaining on Federal Lands. Report to the Honorable Dale Bumpers*. GAO/RCED-92-192. Washington, D.C.

USGS. See U.S. Department of the Interior, Geological Survey.

Van Nieuwenhuyse, E.E. 1983. The Effects of Placer Mining on the Primary Productivity of Interior Alaska Streams. Master's thesis, University of Alaska, Fairbanks.

Vannote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing. 1980. The River Continuum Concept. *Canadian Journal of Fisheries and Aquatic Sciences* 37:130-137.

Viereck, L.A, C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. *The Alaska Vegetation Classification*. General Technical Report PNW-GTR-286. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Vitt, L.J., J.P. Caldwell, H.M. Wilbur, and D.C. Smith. 1990. Amphibians as Harbingers of Decay. *Bioscience* 40(6):418.

Wanty, Richard B., Bronwen Wang, Jim Vohden, Paul H. Briggs, and Alan H. Meier. 1999. Regional Baseline Geochemistry and Environmental Effects of Gold Placer Mining Operations on the Fortymile River, Eastern Alaska. U.S. Department of the Interior, Geological Survey Open-File Report 99-328. Denver, CO.

Warren, M.L. Jr. and B.M Burr. 1994. Status of Freshwater Fishes of the United States: Overview of an Imperiled Fauna. *Fisheries* 19(1):6-17.

Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. *1992 Washington State Salmon and Steelhead Stock Inventory*. Olympia, WA: Washington Department of Fisheries.

Webber, P. and R. Post. 1985. *Aquatic Habitat Assessments in Mined and Unmined Portions of the Birch Creek Watershed.* Technical Report No. 85-2. Juneau: Alaska Department of Fish and Game, Division of Habitat.

Weber, W., and A. Rabinowitz. 1996. A Global Perspective on Large Carnivore Conservation. *Conservation Biology* 10(4):1046-1054.

Webster, J.R. and S.W. Golladay. 1984. Seston Transport in Streams at Coweeta Hydrologic Laboratory, North Carolina, U.S.A. *Internationale Vereinigung fur Theoretishche und Angewandte Limnologie Verhandlungen* 22:1911-1919.

Wenner, Lambert N. 1992. *Minerals, People, and Dollars: Social, Economic, and Technological Aspects of Mineral Resource Development*. Publication R1-92-133. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region.

Wesche, T.A. 1993. Watershed Management and Land-use Practices. In *Inland Fisheries Management in North America*, edited by C.C. Kohler and W.A. Hubert, pp. 181-203. Bethesda, MD: American Fisheries Society.

Western Bat Working Group. 1998. Western Bat Species: Regional Priority Matrix. In the files of Chris Gordon, BLM biologist, Washington, D.C.

Western Mine Engineering, Inc. 1997a. *Mine and Mill Equipment Cost, An Estimator's Guide.* Spokane, WA: Western Mine Engineering, Inc.

_____. 1997b. *Mine Cost Service*. Spokane WA: Western Mine Engineering, Inc.

White, Lane. 1997. A MEMS Report: The Environment, Construction Costs, Mining Codes in Southeast Asia.. *Engineering and Mining Journal* 198(July):24.

Whitehead, R.L. 1994. *Ground Water Atlas of the United States, Segment 7, Idaho, Oregon, Washington*. Hydrologic Investigations Atlas 730-H. Reston, VA: U.S. Department of the Interior, Geological Survey.

Wiemeyer, S.N., E.F. Hill, J.W. Carpenter, and A.J. Krynitsky. 1986. Acute Oral Toxicity of Sodium Cyanide in Birds. *Journal of Wildlife Diseases* 22(4):538-546.

Wilburr, D.R. 1998. Exploration Overview. *Mining Engineering* 50 (May):51-60.

_____. 2000. Exploration. *Mining Engineering* 52 (May):38-48.

Wilcove, D.S., C.H. McLellan, and A.P. Dobson. 1986. Habitat Fragmentation in the Temperate Zone. In *Conservation Biology: The Science of Scarcity and Diversity*, edited by M.E. Soulé, pp. 237-256. Sunderland, MA: Sinauer Press.

Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying Threats to Imperiled Species in the United States. *BioScience* 48(8):607-615.

Williams, C.D. 1997a. Sustainable Fisheries: Economics, Ecology, and Ethics. *Fisheries* 22(2):6-11.

Williams, T. 1997b. Killer Weeds. *Audubon* 99(2):24-31.

Williams, J.E., J.E. Johnson, D.A. Hendrickson, S. Contreras-Balderas, J.D. Williams, M. Navarro Mendoza, D.E. McAllister, and J.E. Deacon. 1989. Fishes of North America Endangered, Threatened, or of Special Concern: 1989. *Fisheries* 14(6):2-20.

Wolff, J.O., E.M. Schauber, and W.D. Edge. 1997. Effects of Habitat Loss and Fragmentation on the Behavior and Demography of Gray-Tailed Voles. *Conservation Biology* 11(4)945- 956.

Woodward, D.F., W.G. Brumbaugh, A.J. DeLonay, E.E. Little, and C.E. Smith. 1994. Effects on Rainbow Trout Fry of a Metals-contaminated Diet of Benthic Invertebrates from the Clark Fork River, Montana. *Transactions of the American Fisheries Society* 123:51-62.

World Gold Council. 2000. Gold Demand Remains Strong. Gold Demand Trends. No. 31. http://www.gold.org/Gedt/Gdt31/Press.htm. London.

Wright, Henry A. and A.W. Bailey. 1980. *Fire Ecology and Prescribed Burning in the Great Plains—Research Review*. General Technical Report INT-77. Ogden, UT. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

_____. 1982. *Fire Ecology*. New York: John Wiley and Sons, Wiley-Interscience Publication.

Wright, Henry A., L.F. Neuenschwander, and C.M. Britton. 1979. *The Role and Use of Fire in Sagebrush-Grass and Pinyon-Juniper Plant Communities: A State-of-the-Art Review.* General Technical Report INT-58. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Young, K.R. 1994. Roads and the Environmental Degradation of Tropical Montane Forests. *Conservation Biology* 8(4):972-976.

Index

- acid rock drainage ... 171-173
- air quality ... 157-162
  - affected environment ... 157-159
  - environmental consequences ... 159-162
- alternatives
  - considered but eliminated from detailed analysis ... 66-67
  - description of
    - Alternative 1 - No Action ... 35-42
    - Alternative 2 - State Management ... 43-45
    - Alternative 3 - Proposed Action ... 46-54
    - Alternative 4 - Maximum Protection ... 55-59
    - Alternative 5 - NRC Recommendation ... 60-63
  - summary tables ... 69-87
- American Indian Resource Concerns
  - affected environment ... 255-257
  - environmental consequences ... 257-259
- Amphibians ... 218-219
- aquatic resources
  - affected environment ... 205-215
  - environmental consequences ... 215-218
- aquifers ... 162-166
- assmptions for analysis ... 125-127
- base metals ... 274-276
- bats ... 221
- birds ... 219-220
- carnivores ... 221
- cave resources
  - affected environment ... 247
  - environmental consequences ... 247-249
- climate ... 156-157
  - affected environment ... 156-157
  - environmental consequences ... 157
- Colorado Plateau ... 164-165
- Columbia Plateau ... 165-166
- comments and responses ... Vsolume 2
- cumulative effects ... 127
- consultation and coordination ... 299-300
- contributors to EIS ... 307-308
- cooperating agencies ... 14
- copper ... 274-276
- cultural resources
  - affected environment ... 250-253
  - environmental consequences ... 254-255

cumulative effects 127
demographic and social trends in the West 259
dewatering 167-169
economic conditions
  affected environment 265-283
  environmental consequences 283-297
edge effects 226
endangered and threatened species 210-211, 222-223
environmental advocacy groups 262-263
environmental consequences, summary tables 105-122
environmental justice 128
fish (See aquatic resources.)
geology 128
gold 270-274
Great Basin 162-163
habitat fragmentation 225-226
hazardous materials and waste management
  affected environment 152-154
  environmental consequences 154-156
historic resources 252
implementation costs 64-66
industrial minerals 276-277
in situ mining, description of 134
introduced species 228
irreversible and irretrievable commitment of resources 128
issues
  needing consideration
    appeals process 25
    claim validity and valid existing rights 22
    common variety minerals 23
    definition of casual use 21
    definition of federal lands 20-21
    definition of project area 25
    definition of unnecessary or undue degradation 19-20
    existing operations 25
    inspection and monitoring programs 23
    Notice and Plan of Operations processing and contents 21-22
    performance standards for operations and reclamation 20
    plan modifications 24
    reclamation bonding requirements 23-24
    state government coordination 22
    temporary or permanent closure 24-25
    threshold for a Notice or Plan of Operations 21
    type and adequacy of penalties for noncompliance 23
  not addressed in EIS
    American Indian trust responsibilities 25-26
    abandoned mine lands 26-27
    agency funding and staffing 26
    BLM cost recovery 26

    - citizen suits 26
    - combining 3809 regulations with occupancy regulations 27
    - consistency with Forest Service regulations 27-28
    - diligent development 27
    - 1872 Mining Law 25
    - NEPA processing of Plans of Operation 26
    - public availability of information 27
    - recreational mining 27
  - significant
    - enforcement and penalties 32-33
    - financial assurance 31-32
    - Notice or Plan of Operations threshold 30
    - performance standards 30-31
    - NRC report consistency 33
    - state-federal coordination 29
- leachate s174-175
- livestock grazing
  - affected environment 234
  - environmental consequences 234-235
- migratory birds 219, 220
- mill and tailings sites, description of 134
- mineral resource development
  - affected environment 128-138
  - environmental consequences 138-151
  - mine development 131
  - mining methods 131-134
  - prospecting and exploration 130-131
  - reconnaissance 130
- Mining Law
  - amendments to 16-17
  - development of 14
  - principles of
    - discovery 15
    - location 15
    - maintenance 16
    - patents 16
    - recordation 16
- nonuse values 282-283
- noxious weeds 192, 193, 228
- open pit mining, description of 133
- paleontological resources
  - affected environment 249
  - environmental consequences 250
- placer mining, description of 132-133
- precious metals 268-274
- prehistoric resources 251-252
- preparers of EIS 304-306
- public participation 300-302
- purpose of and need for action 11-13

- outreach 300-301
- raptors 221
- recreation
  - affected environment 238-241
  - environmental consequences 241-243
- recreational mining 241
- regional hydrogeology 162-166
- regulations
  - existing CFR 3809 text A-2-A-18
- Regulation Team members 309
- reptiles 218-219
- riparian-wetland resources
  - affected environment 194-202
  - environmental consequence 202-204
- scoping 18-19, 301-302
- small mammals 221
- social conditions
  - affected environment 259-263
  - environmental consequences 263-265
- soils
  - affected environment 181-182
  - environmental consequences 183-185
- song birds 219
- southern alluvial valleys 162
- special status areas
  - affected environment 235-236
  - environmental consequences 236-237
- spills 174
- strategic and critical minerals 277-278
- strip mining, description of 132
- surface management regulations/program
  - history of 17
  - recent studies and changes to 17-18
- surface water 171
- tailings impoundments 173-174
- traditional cultural resources 252
- underground mining, description of 133-134
- ungulates 221
- upland game birds 219-220
- use values 282-283
- vegetation ....
  - affected environment 185-191
  - environmental consequences 191-194
- visual resources
  - affected environment 243-246
  - environmental consequences 246-247
- waterfowl 220

water resource
  affected environment 162-177
  environmental consequences 177-181
western mountain ranges....................163-164
wild horses and burros
  affected environment....................233
  environmental consequences 233-234
wildlife resources
  affected environment 218-230
  environmental consequences 230-233

648

☆ U.S. GOVERNMENT PRINTING OFFICE: 2000 — 573-075 / 43001 Region No. 8

Abbreviations

ACEC	area of critical environmental concern
AIRFA	American Indian Religious Freedom Act
ANILCA	Alaska National Interest Lands Conservation Act
APA	Administrative Procedures Acts
ARD	acid rock drainage
ARPA	Archaeological Resources Protection Act
AUM	animal unit month
BEA	U.S. Department of Commerce, Bureau of Economic Analysis
BLM	U.S. Department of the Interior, Bureau of Land Management
CDCA	California Desert Conservation Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FLPMA	Federal Land Policy and Management Act
GAO	U.S. General Accounting Office
GDP	gross domestic product
GSP	gross state product
IBLA	Interior Board of Land Appeals
MSHA	U.S. Department of Labor, Mine Safety and Health Administration
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
ORV	off-road vehicle
PFC	properly functioning condition
PSD	prevention of significant deterioration
RCRA	Resource Conservation and Recovery Act
RMP	resource management plan
ROS	recreational opportunity spectrum
SBA	Small Business Administration
T&E	threatened and endangered
TMDL	total maximum daily load
USBM	U.S. Department of the Interior, Bureau of Mines
USDI	U.S. Department of the Interior
USFS	U.S. Department of Agriculture, Forest Service
USGS	U.S. Department of the Interior, Geological Survey
UUD	unnecessary or undue degradation
VRM	visual resource management

END

03-13-01